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A SECOND JOURNEY AMONG THE SOUTHERN TUAREG:

A paper read at the Meeting of the Society on 23 April 1928, by

FRANCIS RODD

AFTER a first journey in 1922 to the people and country of Aïr in the South Central Sahara, it was a relatively simple task to describe in general terms the mountainous plateau and the Tuareg dwelling there. They were so little known to English audiences that anything, however commonplace it might seem out there, was novel enough to be of interest. To return to the subject after a second tour in much the same area is a far more arduous task; especially as a recent account by Mr. Cameron of a singularly plucky journey from Kano to Algiers by way of Aïr provides as satisfactory a picture of Saharan travel as any one who is not a specialist can want. If I am to avoid metaphorically going over old ground, though I certainly did in fact revisit familiar places, I must assume as known that which I had occasion to describe in 1923 and 1926.*

My journey in 1927 among the Southern Tuareg, in Aïr and west of the plateau, took some ten months in all. I had two companions, Augustin Courtauld and my brother, Peter Rodd.

The expedition had the consent of the French Government and everywhere enjoyed the assistance and sympathy of the local French authorities. Before our departure the Council of the R.G.S. saw fit to bestow on me the Cuthbert Peek Award for 1927 and to lend a number of valuable scientific instruments, some of which were purchased for the purpose. The object of the expedition was to continue mapping the Aïr mountains and investigating the habits and origin of its Tuareg population. In this our objective differed not at all from that which I had had in view when in 1922 I travelled for a period with Capt. Angus Buchanan, who, in the course of making a cinematograph film, continued his collections of the birds and beasts of the Sahara.

Anthropological and geographical work of the type attempted on my two journeys is unfortunately not productive of sensational results. We discovered little of general interest, nor did we have any adventures worth discussing. It is doubtful whether to-day there is any really sensational geo-

*See *Geographical Journal*, August 1923, January 1926, November 1926, May 1927 (including a paper by H. R. Palmer about the Tuareg and a review of the author's book).

graphical discovery left to be made, save in very few areas of which North Africa is probably not one. Adventures, moreover, as has been said so often before, ought not to befall properly conducted expeditions except in the hundredth event, which, even if it be foreseen, can nevertheless not always be prevented. I do not mean to imply, either that there is not plenty of important geographical work left to be done in the world, or that there are not thousands of petty events in exploration which, if annoying, serve at least to relieve the monotony of slow travel under the rather primitive conditions still obtaining in the Sahara where motor cars cannot penetrate.

The account which follows will deal only with general conditions of travel and descriptions of methods used. All the scientific data collected have not yet been worked out. It may well be that some of our work will prove to be of particular interest in connection with current research in North Africa, but this is not the place to anticipate such conclusions by unsubstantiated speculation.

We reached Nigeria during the second half of May. It was rather late in the season, as the summer rains, due to commence there that month, render travelling by camel nearly impossible and certainly very miserable. Thanks to friends in Nigeria, notably Mr. H. R. Palmer, Governor of the Northern Provinces, preliminary arrangements were rapidly completed. He lent us his personal servant and a Tuareg orderly who had been with him many years; they were sent down to meet us at Lagos. Other boys were engaged at Kano, where they had been found by the authorities, who also arranged for us to buy camels at Katsina. Thither we motored 100 miles from railhead, bought twenty-one expensive but good beasts, hired fifteen more from Kano, and set out for the north on May 31 just as the rains were breaking, luckily rather later than usual. The party then consisted of our three selves, "Arab" the Tuareg orderly, three servants, four of our own camel-men, three hired camel-men, and a small coast boy called Joseph to do odd jobs. The camel-men were all Tuareg, but of the serf caste or slaves with one exception, who like Arab was a noble. In the course of the journey the party varied in size as need or necessity governed, usually numbering some twelve to fifteen souls in all. For this band, food, clothing, and luxuries for eight months in the country were carried in addition to scientific instruments, water equipment, tents and tarpaulins for use during the rains, tools, presents, and other stores. Our armament consisted of eleven Mauser rifles, of the German Army pattern, and two shot guns. The only shooting we did was for the commissariat, as most of the time this was the only method of getting fresh meat. We had brought only a limited amount of preserved meat for emergencies, since grain had to be carried for our men, who consumed some 500 lbs. a month, too weighty an item in our transport train to permit of much superfluous baggage. Even so we never managed with less than thirty-two camels, of which thirty, including ten riding-camels, were our own property.

Two days' march from Katsina we entered French territory, making our first contact with the French authorities at Tessawa about the same distance farther on. Here by a narrow margin we escaped becoming involved in a tragic incident in the course of which some Moslem fanatics murdered a French employé a few hours after we had marched out of the town. Most of

the miscreants have since been brought to justice by the French and British authorities, but it is sad to think that tragedy might have been averted had we arrived in Tessawa only a day later, when the presence of so many additional rifles in this otherwise peaceful place would probably have deterred these religious maniacs from their attempt. The outbreak was undoubtedly of a politico-religious origin, but fortunately had no repercussions elsewhere.

Through the belt of cultivated land and bush separating Equatoria from the Sahara we passed as quickly as circumstances permitted. The rains had now begun to fall in earnest. Every few days we were inundated with tropical rain-storms, terrified by imminent lightning, and blown out of camp by circular wind squalls. At this tail end of the dry season, one of a sequence of five arid years during which pasture had never been good, the loaded camels were weak and required nursing. They were feeling the heat. The Sahara summer is at its height in June. Water points were then at their worst and fewest, for the storms had not yet been sufficient to form pools. Pasture was everywhere at its lowest ebb; the bush was very trying. We left the last water of the bush belt at the deep well of the T'inawgarakan valley. Our next point was Tagedufat well in the steppe desert south of Aïr on the Tin Wana road, which I had followed in 1922. We found the well at Tagedufat sanded up. It took nineteen hours' hard work to dig it out before we finished drawing water for our thirty-six camels and drinking-skins. Although we were all tired after working from 11 a.m. one morning until 7 a.m. the following morning without a break, we could not afford to stay owing to the lack of pasture; so when the camels had rested after drinking, we moved off at 3 p.m. in the blazing heat with the temperature, as it had been for many days, considerably over 110° in the shade. But at 5 p.m. we were overtaken by a sand-storm and had to camp hastily, as visibility fell to 25 yards. The sand wind was followed at about 10 p.m. by rain lasting into the small hours of the night. Then the camels began to stray, as they were hungry. The Desert had evidently determined to give us a taste of everything.

But next day was fine and cooler. We did ten hours to Milen, where rain overtook us at the dry well, and then nine hours to Tin Wana pools up a valley which drains a small sandstone group, the only hills south of the river of Agades, the southern geographical boundary of Aïr. We camped in a gorge full of old memories for me, to copy the petroglyphs and inscriptions, which abound on the rock faces above the pools in the stream bed. But as much perhaps as any archæological interest, we were drawn to this place by the prospect of swimming in the main pool, which is over 30 yards long when full. The finest rock drawings were actually discovered in the neighbouring valley of Tajberat: they were rudimentary in style but presented some very interesting features, to which reference will be made hereafter. Courtauld began serious geographical work by plane-tabling the Tin Wana and Tajberat valleys.

Our plan was now to hasten into standing camp at Auderas to await the worst of the rains, which in Aïr occur somewhat later than in Nigeria, between July 15 and August 31. Having lived there for two months in 1922 I chose Auderas once more, partly because the greatest pleasure to which I looked forward and did experience, during my return to Aïr, was to see old friends

again, and partly because the villages were a good centre for mapping those mountains which French maps had hitherto depicted as the western side of the Bagezan massif. This area however, as I had discovered in 1922, was really filled by two mountain systems, the Bagezan mass proper and the Todra-Dogam complex, divided from each other by two considerable valleys flowing respectively north and south and separated by a low col which had not been recorded.

On leaving Tin Wana we therefore made for Central Aïr, staying at Agades for a few days on the way with the French officers at the fort. We much enjoyed their kind hospitality there during the festivities attending the Fourteenth of July celebrations.

Thence we marched north to take up permanent quarters at Auderas in a large hut built for us by Ahodu, the chief of the village. The camels went away to feed on the new rain-grown pastures south of the valley. We feasted on fresh vegetables, dates, and cheese, and measured the rain which fell nearly every afternoon. These were very pleasant weeks. The annual rebirth of trees and grass after the rains in the Saharan mountains is an episode in nature which no other experience of life can dim. Aïr is always a country of vivid colour where the cruel glare of an unshaded African sun is tempered by the shadows of morning or evening on the towering masses of red and black rock. But in the rains white clouds like mountains of foam ride over the sky on the north-easterly wind, throwing changes of shadow and colour over the hills and green valleys. Stony plateaux where no living thing, it seems, can grow, are covered in a few days after the first showers with a bloom of green like the complexion on an inviolate fruit. The larger valleys are bordered with stately trees. Amid thickets of dum palm the camels wade deep in flowering grasses, and you smell the unforgettable scent of acacias blooming in their carnival of life with all the latent store of energy they have accumulated during months of sterile dryness and sun.

The rolling crest of Todra and the peaks of Dogam were placed on the map with sufficient accuracy for practical purposes, by a rough triangulation based on the astronomical position of my 1922 camp at Auderas recomputed in 1927. We measured a small base and extended it. Then day after day Courtauld climbed laboriously about the neighbouring peaks intersecting landmarks with a theodolite. Mount Todra was attacked by Courtauld and my brother, but they failed to reach the prominent peaks on which we were working, called P_3 *a* and *b*. They left one afternoon after the usual daily thunderstorm had occurred, with three men, instruments, and food. Whereas the false top, or Todra "Whale-back," is easy to reach, the P_3 peaks are separated therefrom by deep clefts and a knife-edge of unscaleable blocks; so they had to travel light. They took no bedding, but one mackintosh between them, and except for some spare sandals no clothes other than those they had on, namely a drill coat, a curtailed shirt, and shorts. The top of P_3 *b*, as we subsequently ascertained, is 7 miles by map from, and 3300 feet above, Auderas camp. Peter Rodd's account, written in our log-book, reads as follows:

> "We travelled on foot over very rough country with our guide and two men. The guide, Isselu, turned out to be rather a disappointment, as he did not guide us along a way so much as chose a point to march on and made a bee-

Agades from the mosque

Tin Wana pool

Camp in Tin Taralle valley

N'Gora pool, Arli hills, Western Aïr

line for it, very much too fast, and across or through any intervening obstacles. We reached the ruined village of Abattul at sunset, having sore feet but a fine view. The penultimate portion of our trajectory pursued the indentations of the homonymous watercourse; its conclusion left us situated on a diminutive plateau overshadowed by the perpendicular precipices of the eminence called Guzher.

Our night was just fine, but not very far away it was not. A full moon and racing clouds, some black with the menace of rain, and some all silver, played with the shadows of the hills, making mysteries in the ravines and wonders on the heights. There were several ghosts in the ruined houses of the village.

We started at 6 a.m. next day by a rough scramble up the right bank of a vast gulch which splits Todra but is modestly hidden from the eyes of Auderas by the rocks of Guzher. We reached the summit of the eastern "hog's back" at 10 a.m., and regretted the lack of skill which, in spite of a merry fusillade, had lost us the chance of eating mutton (mountain sheep) with our dinner. We discussed this and set up the theodolite, only to get rained on before we were half finished.

So we sat in a bush all the afternoon and let it rain, for as a matter of fact we could not stop it. In the evening we reconnoitred the southern portion of the main block and found that it consisted of a series of small valleys which drained a little plateau. The valleys spilled southwards into a huge gorge which runs S.W. and separates Todra proper from Ghobitan (P_3). We stopped in an anonymous glen 5000 feet up; the place was green and fresh, with a little circular crater at its top end and a precipice where it reached the edge of the mountain. It was a very wet night; our dreams were not sweet, since we were using wet haversacks for beds only because they were a trifle better than biscuit tins.

Next day being August 10th we saw some mutton (potential) and converted it into mutton (actual). A fine breezy morning, but the ovine operations considerably retarded out progress in the direction of the mountain, of which it was our intention to attempt the ascent. We arrived after a difficult walk only to find another huge gulch between us and Ghobitan, the peak of our desire, the goal of our hopes. We saw rain coming, and thought it was time we hit the trail for home. We got more rain and sore feet, but made the Auderas hut at 3 o'clock in the afternoon. . . .

A few days later I went off by camel with Ahodu over some country that seemed beyond the capacity of even a self-respecting mule to climb. We located the low pass between Bagezan and Todra, and found that the Dogam group consisted of isolated volcanic domes, rising out of an extensive flat high plain some 1000 feet above Auderas and hitherto unrecorded on maps. Courtauld meanwhile attacked Ghobitan again from the south and succeeded in reaching the summit with a theodolite. On the way back he climbed another conical peak called Tegbisheri, and as usual got soaked every day by the storms. My brother then climbed Todra "Main Peak," a knoll behind "Whale-back," and returned to camp the same day—a very fine performance over such rough ground. A few days later he did a valuable reconnaissance north of Auderas and was again soaked, five times in three days: but he succeeded in filling in a large blank on the map with much intricate detail, breaking up the larger mass of the Mount Bila of French maps into several distinct groups. Our stay at Auderas drew to its close with the end of the rains. We had mapped roughly, but in such detail as had not before been

attempted, some 400 square miles of country, basing our maps on a rough triangulation with some twelve coordinates computed from a good astronomical position. [*See map at the end of this Journal.*]

With the additional camels bought and exchanged at Auderas we set out for Northern Aïr by a more eastern road than I had previously attempted. My old friend Tekhmedin, the greatest of all guides in Aïr, joined us as head of the caravan and took over all the men and camels. We had some difficulty in getting camel-men among the sedentary Tuareg of the villages, but, after one refusal to move, collected enough men to work our way north. The grain I had ordered at Agades, from the south, arrived in sufficient quantities to tide us over until the few gardens in Aïr itself should produce enough to enable me to fill our requirements locally; we carrying at this stage our minimum ration, enough for about five weeks, of 600 lbs. of millet and wheat.

We marched north by a route east of Bagezan, but Eastern Aïr had not had its share of rainfall. The country was very dried up. We followed the old Kel Owi road down which Barth went to Nigeria, along the immemorial caravan way from Tripoli to Kano. The Kel Owi track in Aïr has been abandoned these twenty years, partly on account of lack of water and partly because the population remaining in Aïr has moved from the eastern to the western fringe of the plateau where the pastures are much better. Such caravans as now cross Aïr pass west of Bagezan, through Auderas to Tagedufat, or farther west still by Agades and Abalemma well. The eastern country was very interesting geographically, but lack of water prevented us from lingering on the road. We were short of water nearly all the way till we reached the well of T'intaralle in the beautiful valley where Richardson and Overweg camped for several weeks while Barth made his excursion to Agades and back before the party proceeded south. Eventually we reached Iferuan in the Ighazar valley, well satisfied with our journey, and put the camels to pasture some 12 miles away, ourselves going into camp with them a few days later. The rest was necessary for the animals to get fit enough to cross the desert between Aïr and the Niger, which we decided should be our way home, for I was particularly anxious to see the country and people west of the mountains where most of the nomadic Aïr Tuareg now live on desert pastures as far removed from European contact as possible.

The deserts north, east, and west of Aïr are all rather grim regions. Many reasons which made us select the western desert would not be of interest to discuss, except to explain that there was a good deal of work to be done there; some parts we crossed had never been seen by Europeans at all and most of it had not been visited for many years. There were a number of wells and some rock outcrops that seemed worth recording. Before, however, embarking on this enterprise we were destined to encounter certain further difficulties with our camel-men, who except for Tekhmedin and Arab seemed unwilling to leave Aïr at all in any direction. The delay however proved fruitful, for we were enabled to do the French authorities some service.

It may be known that every year a large camel caravan leaves Aïr under the escort of a platoon of French camel corps, for the oases of Fashi and Bilma across the eastern desert. A small unescorted caravan also leaves in the spring, but the autumn enterprise is the great and famous Taghalamt on which

several thousand camels are sent annually, to load salt and dates in Kawar. It was the great escorted autumn caravan which my travelling companion Buchanan accompanied in 1922. This annual undertaking entails much military preparation to afford it security against the raiders who, before the French occupied the Sahara, made it their goal and prize of many expeditions, The number of camels (before the war as many as 27,000 were counted, though now they rarely exceed 4000) makes the Taghalamt not only a valuable but also a most defenceless prize. In addition therefore to the military escort which for many years past has been provided by the authorities, such other mobile troops as are available and all the native Tuareg auxiliaries that can be trusted are despatched on patrol to look for suspicious camel tracks and occupy outlying water-holes where raiding bands entering Aïr from the north or east might resort. One such water-hole of considerable importance lies 75 miles north of Iferuan on the road to Janet and the Fezzan. In October 1927, for some reason which I cannot explain, the fifteen auxiliaries who were to have proceeded on patrol to Tarazit failed to report for duty, leaving an obvious and important road of access to Aïr unwatched and unguarded. Hearing of this, we volunteered to find and mount a patrol in their stead, and our offer was accepted by the local French authorities.

We therefore selected from our resources nine good riding-camels and six men, armed them with our own rifles, and in their company proceeded to Tarazit. To ensure speed and mobility we only took riding-camels, and on our saddles carried just enough grain, sugar, tea, and salt to last fifteen days, in addition to water and a blanket each. We trusted in our constitutions and the possibility of finding some game to supplement deficiencies in equipment and food. We travelled in fact like natives and could have moved as fast, but although some days we covered 35 to 40 miles, we were not in the saddle for long hours as the speed we made was very good. On the third day we entered the Tarazit gorge, not by the usual way in case it was occupied by raiders, but over the mountain-tops, climbing laboriously down a sheer boulder-strewn slope into one of the most picturesque gorges imaginable. The pasture was adequate, so we camped at the main pool, made our home in a cave, and, according to instructions, kept four days' watch and local patrol for suspicious persons. Although, as we later heard, alarming news of the advent of a raid was officially notified throughout Aïr, nothing untoward happened to us. We lived on wheat rough-ground between granite boulders, Addax antelope meat roasted on the cleaning rods of our rifles, and swam in one of the most lovely pools in the world a little farther up the gorge, where the valley narrows to a cleft with unscaleable sides. We were further rewarded by finding some interesting rock inscriptions.

Our return journey from this last most northern massif of Aïr was less pleasant. Even in the protected gorge of Tarazit, some 2500 feet above the sea, the nights were already cold. The eastern route, which we elected to take because the maps of the area appeared rather blank or very vague, was bitterly cold. For some 70 miles we observed no living animal or plant, a tremendous contrast to our outward route where, west of Tarazit peak, pasture was excellent and game plentiful. Rain in the north is apt to be very local, and obviously none had fallen in the eastern part of Fade, as the area

is called, for many years. Yet the wilderness of sand and rock was not uninteresting; the mountains of piled round boulders rising out of wide sandy valleys that mark ancient and occasional basins of drainage were most picturesque. But the camels were very hungry before we reached the more smiling valleys which drain the northern slopes of Tamgak and so rounded the massif back again to Iferuan.

This excursion of some 150 miles was useful from the cartographic point of view. Observations and information collected from our guide confirmed my previous impression, that the whole of Fade lies in the T'immarsoi drainage basin and does not constitute a watershed between the Niger and Lake Chad. Even the small, apparently eastward-flowing valleys of the Fade massifs and the northward-flowing valleys from Tamgak do not cross the desert towards Kawar, but curl round north and eventually, above In Azawa, join the Tafassaset, which of course ultimately becomes the T'immarsoi, forming the great drainage basin west of Aïr trending toward the middle Niger. From the Ighazar valley the country rises gradually to the Tarazit massif valleys, thereafter sloping definitely down to the Tafasasset at In Azawa. Just east of the Tarazit group is a large compact massif called Grebún, probably the highest position in the whole Aïr plateau.

Within four days of our return to Iferuan we had collected some men, all our remaining camels and kit, and set off for the western fringe of Aïr to look for a group of rock inscriptions and prepare our journey westwards. The band of men who suddenly decided to go with us was almost overwhelming. One day out of Iferuan we came upon Ahmed of the Hadanagh tribe of northern Azger Tuareg. We had seen him on and off at Auderas, at our camp near Iferuan, and now again at his camp, where we halted to have a talk while our caravan went on. His wife played the amzad—a one-stringed violin—to us while we drank milk and discussed plans. We asked him if he would come with us to Timbuktu; he agreed to do so if he could bring his man Ewad. We had no objections, so Ewad went off to catch some camels, for Ahmed was a man of wealth, having several herds of goats, some cattle, and twenty odd camels of his own pasturing near by. The camels came in, and Ahmed and Ewad rode on with us at ten minutes' notice to do a journey of over 500 miles each way without discussing salary or reward, or having any man to leave in charge of his women and property.

A few days later we camped at Arli water on the edge of the western hills, where a low "bouclier" of horizontally stratified sandstone slopes down by a series of intricate valleys and bare flat tabulated hills to the sea of sand which is the western desert. On arrival our head camel-man Abenner, of the Kel Tadele, went off to find an old man of his tribe who was reputed to know the way to Kidal in the Ifoghas hills. We were well enough staffed to dismiss two men who were not needed when the guide arrived, one Khayar, a presentable old man who had often raided the west in his younger days. After arranging terms he went home to get his travelling dress, a series of rags tied on with bits of hide contrasting sadly with the rather smart garb in which he first appeared. He was so disreputable and miserable on the journey that Courtauld presented him with an old khaki flannel shirt to wear at night, as he had brought no blanket and we could not spare any. Khayar, however, wore the

shirt by day as well, a really lamentable sight with his veil, white trousers, and fluttering khaki flannel tails.

From Arli, Courtauld and my brother went north to Mamanet to investigate a series of rock drawings of some repute. The whole country around as well as many of the valleys on the way from Iferuan were full of petroglyphs differing in some respects from those found in the south. The human figures hammered in the rock, probably with a sharp hard stone, were more elaborate. The Tajberat "figure of eight" men were absent; instead of them we found figures with ornate flowing dresses and often accompanied by other broad-hipped figures, either women or men in trousers. As at Tajberat, nearly all had feathered or tufted head-dresses and most of them the characteristic Libyan lock on one side of the head. Unlike the modern Tuareg, they were usually armed with small round shields instead of the modern long shield, and were associated with horses rather than with camels. On the other hand, the almost invariable presence of T'ifinar inscriptions suggested an indubitably Tuareg origin. The main group at Mamanet was executed in negative bas-relief; in other words, the rather soft and friable rock had been hollowed out to represent, somewhat crudely, the human figure. The pictures, probably originally outline drawings and only later hollowed out, are locally reputed to represent the prophet Elijah with his wife and small boy.

The attribution is interesting owing to the presence north of Iferuan of a pinnacle believed by the Tuareg to have been a hermitage long occupied by Elijah until the "Rumi" came to besiege and capture him. There, in answer to the prophet's prayer for deliverance, God caused the living stone to rise up and become a mountain, carrying the cave which was the hermitage towards the sky, away from the ring of fire which the infidels had lighted around the base. The tradition is a curious mixed echo of the Biblical stories of Elijah and Elisha.

The Arli plateau is a maze of meandering gorges cut deep into the Tertiary sandstone and abounding in pools—permanent, semi-permanent, and temporary. The vegetation in the ravines is hidden from view; the bare rock top of the plateau in tabulated stretches is as uninviting at noon-tide as the road to Hell. At one of these pools, south of Arli, we watered our camels and filled our skins before beginning our 500-mile march to the Niger. Khayar the guide had explained that on our road the first well, which had been visited by French patrols before the war, was now undoubtedly dry, but that a short day beyond there was a new well called Battal, which however neither he nor his friend Abenner had ever seen. Nevertheless they thought they knew, according to the descriptions they had heard, where it should be located. Our trouble throughout this journey was that there had been no regular communication between Aïr and the Ifoghas country for many years; no news could be obtained of extant wells, or, what was even more important, of pasture areas. Now pasture, especially in the winter, is of far greater importance to working camels than water. In cold weather a day or two more or less between wells does not matter; but if camels do not eat for three days, even if they are in good condition, there is a risk of their collapsing. The whole problem of travelling in the Sahara is that of keeping camels fit, and it is extraordinary how quickly they lose condition. So much constant attention

do they require that many travellers have asserted that it was a hopeless task for Europeans to buy and run their own camel transport. Proof of this was locally adduced in that a certain group of French camel corps, where much care could be and was exercised, had found the average life of an animal in service did not exceed fifteen months before it either died or had to be cast as unfit.

I have however myself always believed that if constant care is paid to beasts and personnel, a European can own and organize his own camel transport on a fairly large and economical scale. One of the most satisfactory results of this journey was the proof of my contention. We bought in all thirty camels; they were by no means young or prize beasts; many of them had bad sores and were in a very poor condition when we obtained them. During our journey we used our camels well and at times loaded them heavily. Yet all thirty survived. They completed the journey across the desert and were sold on the Niger as well as we could have expected in our hurry to dispose of them. Moreover, the five best we had were given away as presents to some of our men for their very excellent services. Not only did we not lose any camels by death, but we only had one with a sore back at the end of our journey, and that not a very serious case; we had started with several rather grave gangrenous sores. But we took constant care of our beasts and devoted adequate periods to pasturage and re-conditioning. I insisted on one of us three always attending the watering of our herd, not because we could do anything but follow the advice of Tekhmedin or Arab, but because when the Tuareg camelman once sees that his owner is really keen, he takes immense trouble to do his best for the charges in which every one of his race is by nature intensely interested. And in this work nothing was ever too hard for Arab or Tekhmedin, either by day or by night, or however tired they might be after travelling or tracking strayed beasts. I wish there were occasion here to say more about camels and their care, for it is a great subject. He is an impossible animal in every way, and I have no personal affection for the beast. The truest thing ever said of the camel was that Providence manufactured him in a fit of abstraction. But with all that, I ever find him a pleasant pastime and an efficient means of transport in his own inimitable way.

Next in importance to keeping your transport fit is to provide water and food for your men, and especially the former. Being a terrible coward in matters of water, I was quite unnecessarily careful before leaving Aïr with Khayar for the wells of Battal. We possessed rather over forty skins and two tanks each of 15 gallons. A good skin should hold 12 or more gallons, a medium one about 10, and a small one 6 or 7. We left the pools south of Arli on November 12 with six water camels carrying two tanks and twenty-two selected skins averaging 10 gallons, weighing well over 2500 lbs., or rather over a ton (net) of water. This was an ample supply, but in the desert skins lose much by evaporation and sometimes break when a camel throws its load or tries to roll on the precious supply. Still, as it turned out, we always had in hand throughout the journey over two days' full ration of water at a gallon a man a day. This explains why I said I was a coward in such matters.

It is impossible to describe a journey across a desert to any one who has never seen such country. The area west of Northern Aïr is a particularly un-

pleasant desert. For over 100 miles west of Arli we crossed bare flat "serir," a desert of small pebbles lying on hard sand. There were no landmarks at all after leaving the last small outcrop of rock in a depression called the Belly of the Carrion Eagle. There was virtually no pasture for five days, the camels were only saved by a narrow margin of time and the lucky presence of two small patches of desert grass and gorse called "hadd." Mirage used to begin at 6 a.m. and went on till 4 p.m. It was of such intensity that 400 yards away everything all round oneself became a sea of milk. Courtauld, who was traversing our route with prismatic compass and clock, complained that he could find nothing to sight on, that when a stone or tuft of grass could be discerned it disappeared almost at once, or that such objects stood up in the sky like drunken grand-pianos. I suggested his marching behind the caravan and sighting on the head to give some sort of direction; and this proved to be the only practical solution.

We were up before dawn every day and marched until late in the afternoon or evening, wandering a little off our course at the end of the day to look for a chance piece of "hadd" or some sticks of dry "alwat" for firewood, for it was very cold at night. Yet in this 100 miles of march from the last rocks of Aïr to the first recognizable landmark near the valley in which we hoped to find our dry wells, without compass, clock, or leading marks to march on, Khayar steered a course which, when plotted from and to astronomical positions, never diverged by as much as one mile from its true bearing. On the night of the third day out, having overheard some arguments about geography going on, I went to where the men were squatting about their small fire to ask where we were. Khayar explained that he did not really know: we were either in a place rejoicing in the ominous name of In Khaghshi, meaning the "Valley of Maggots," or else not yet so far. This did not sound very reassuring; however, next evening we saw a group of five small trees near a line of loose sand-dunes, and knew them to be the "landfall" to which he had been steering. Presently pasture increased, and we saw a belt of trees to the south in the great basin or Belly of the Western Desert called Tesallaman. Here we were ultimately bound to reach some wells and felt more reassured. It may be well to add that the valleys so pompously marked on maps of this desert are shallow depressions and, unless they contain trees, quite unrecognizable as such to an untrained eye in the uniform plain of "serir." When bare, the only way of recognizing a valley is to try to see where the bank of mirage is deepest at noon, or to watch the shadows at sunrise and sunset. But even so it is almost impossible to discover whether such hollows as may be suggested possess a definite trend or are merely very slight local undulations.

In due course we reached a valley flowing into the Tesallaman from the north-east, from the Arli area as we heard; it had been running more or less parallel to, but north of, our route. Here we found the dry wells of In Allaran. It was a bloody place, for the name means the Valley of Spears and commemorates a battle between the Aïr Tuareg and their western neighbours in some forgotten generation long since. Some hours beyond in a patch of wonderful desert pasture we reached the wells of Battal and the remains of a rain-pool in a hollow surrounded by some small bare dunes, at the exact point where Khayar and Abenner had expected the water to be. We stayed there

a day to rest and feed our camels, making friends with a large caravan of Ahaggar Tuareg, watering on their way from the north to buy corn in Damergu.

On reaching Battal our procedure was similar to that adopted whenever we halted at important points. Since on this part of the journey we were travelling rapidly and not spending more than one whole day at any "rest camp," work began as soon as camp was made. Before sunset the instrument cases were opened and the wireless receiver, batteries, and frame aerial connected up. The theodolite stand was set up at the well or at whatever recognizable point had been chosen to determine the position by stellar latitude and longitude observations. Before sunset or whenever there was leisure on previous days Courtauld selected stars suitable for observation and tabulated them in a notebook. As soon as darkness fell I used to erect the theodolite and look for the stars, usually complaining that they were either too small to identify or too high to look at without a diagonal eyepiece, an attachment which I have always particularly disliked. My complaints were invariably met by an abject apology and admission of my most reasonable grounds for complaint from Courtauld, subtly combined with a spirited defence, placing the whole responsibility on the obvious shortcomings of the Nautical Almanac. After these preliminaries he would disappear to take a wireless time signal at 8 p.m. and leave me to make the observations, with my brother entering the results in various books and reading the chronometer times recorded by myself with the help of a split-second stopwatch. The Tuareg were not really interested in our observations; they explained that they understood it to be perfectly possible to find out where one was by measuring the place of stars in the night sky, but they failed to see the necessity of doing so since they already knew the names and whereabouts of all the places we had selected as requiring to have their positions astronomically fixed. Undeterred by this lack of enthusiasm for scientific geography, Courtauld used to sit down with a chronometer and two chronometer-watches, ascertain the error of the latter on the Bordeaux automatic signals during the ten minutes preceding 8 p.m., that of the former on the rhythmic signals during the five minutes after the hour.

Our wireless receiving set was designed for long-wave reception only; as the shortest wave it would receive was 14,000 m. we could never receive "broadcasting," but, on the other hand, it performed the functions for which it was intended most admirably. On no occasion on which we desired to do so, did we fail to receive time signals for which we were listening, though of course with the violent atmospherics for which the Sahara is noted there were better and worse days. Such nevertheless was the delicacy of the apparatus that, in addition to European stations, we were enabled to pick up Saigon in Cochin China, and Cayenne and Washington in South and North America with great clarity, in daylight and in the forenoon of our (Greenwich Mean) time. The apparatus complete with frame aerial and spare batteries constituted only one camel-load, though we usually carried the frame aerial as a light half-load on another beast, since we always had enough spare transport to rest a weak animal in this way.

The production of this apparatus by the Marconi Company and our modern surveying instruments, for the most part lent by the R.G.S., proved

Camp on Serir

Camels in Alwat' pasture, Western Desert

Battal pool, Western Desert

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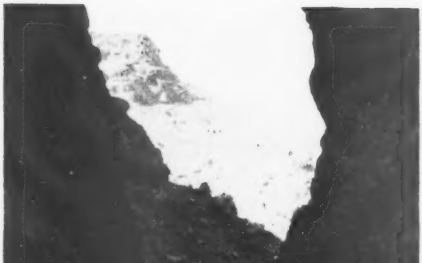


Upper gorge, Tarazit, Northern Aïr

Tarazit pool and valley, Northern Aïr

that even a small private expedition can obtain not only latitude but also longitude correct within a couple of hundred yards with scarcely any difficulty.

Our observations followed a definite routine. I had come to the conclusion in 1922 that by limiting the types of observations to one or two, considerable perfection could be obtained more than compensating for the lack of variety. We used therefore to take on each evening in rapid succession a set of circum-meridian altitudes each of a selected north and south star between 25° and 50° altitude, and a set of east and west stars for time at similar altitudes. We succeeded in averaging one (Face Right or Face Left) sight every two minutes, and during the last weeks of our journey reduced the interval to 70 or 80 seconds. This was achieved by always following the same procedure, by which Courtauld did all the time work, my brother all the recording, and myself all the theodolite sights: we were nevertheless practised at interchanging the duties in case of sickness. Such a series of four sets of observations with all the time signal work involved might take as little as an hour and a half, but if suitable stars were not available might keep us up till midnight, though not later. The result of our astronomical work has been to move the whole of Aïr some 2 to 5 miles farther east on the map than it had been fixed by previous French observations, which had been taken without W/T time signals.

At Battal the night was very interrupted after our observations. Our camels tried hard to drink at the puddle which had survived the rains, but the surface water was so bad that they had to be driven off—rather difficult work on a dark night when the phenomenal activity of these extraordinary animals seems to be miraculously intensified. Our proper watering the next morning was tedious, as the surface wells kept on falling in.

On the following day we marched on, and in two stages came accidentally upon the wells of In Nuguren in a torrent bed cutting the slope of a limestone scarp which suddenly appeared out of the desert, the first eminence except for some distant hills to the south of Battal we had seen since leaving Aïr. Between Battal and In Nuguren we re-entered the desert north of the Tesallaman depression crossing the broad shallow T'immarsoi valley, the head of which is on the Mediterranean watershed near Ghat, in the Azger country between Ahaggar and the Fezzan. There was something rather awe-inspiring in crossing this valley, which in remote times was probably the upper channel of the present Middle and Lower Niger, and divided with its northward-flowing companion the Ighaghrar system, the Central Saharan rainfall to the Bight of Guinea and the Mediterranean respectively.

The Tesallaman basin is not, as might be imagined, a sump into which the precipitation on Aïr, S. Ahaggar, and the Ifogas country drains: it does not in this, even after the rains, resemble the great closed basins of the Western Sahara. The Tesallaman is a broad valley with a marked northern edge, cut, it is true, by wide affluents such as the In Allaran, T'immarsoi and Abarakat, but having a distinctly appreciable bank, of not less than 50 feet between the bottom and the edge of the desert to the north. The surface of the valley bed, rather wider at Battal than farther west, is in part well clothed with desert scrub and innumerable very small acacia trees in belts or patches called Efei, meaning apparently "shady places," but in part also very bare. Marching westward along the northern side, vegetation grew less and the valley

narrowed, at In Nuguren to a few hundred yards' breadth of desert grass or tufts between two limestone scarps some 10 feet high. It then broadened again, sweeping south-west as the Assakarai or Azawak towards the Niger near Gao, changing its name several times on the way. The bottom of the valley at Battal is only 1100 feet above the sea against 1800 feet for Arli and 2500 feet for Tarazit.

At In Nuguren we found a stratum of fossil shells under limestone. West of this point the country became more interesting: we passed a series of isolated limestone scarps oriented approximately east and west, some 50 to 150 feet higher than the plains out of which they emerged. On the second day after leaving In Nuguren I let the caravan go on and went to visit one such eminence called Sadaro lying north of our road. I had some difficulty in rejoining the caravan as a strong wind had effaced the tracks which I was counting upon to follow, and I had no one with me who knew the country. When we finally caught sight of the camels I discovered that a north-westerly course instead of a westerly one was being followed. Coming up with them, I was told that the guide Khayar, convinced that the hollow towards which he was heading was the place he believed to contain a well, had suddenly confessed that he did not know at all where he was, and that he had only struck In Nuguren itself, now three days' march behind, by mistake, never before having been there himself. This news boded ill for the balance of some 200 miles which we still had to do, but we were in luck, for in the depression called In Dunan we found good pasture and a camp of Mushakara, a half-Arab and half-Tuareg people, servile to the latter. They provided a boy who conducted us to In Aridel, the "Hyæna Well," located next day some 20 miles from where Khayar had imagined it to be. The water-holes impregnated with gypsum lay picturesquely in a ravine leading down to a great broad valley hemmed in by white limestone cliffs rising over 100 feet to the surrounding desert. The valley bottom and next depressions beyond contained much good "alwat" pasture, a sort of fleshly plant in appearance somewhat between a big vetch and a degenerated cabbage. Green, it is very good for camels and contains sufficient moisture to render water almost unnecessary in cool weather. It was already drying off in brittle orange leaves which crackled as they fell with a sharp dry sound.

We stayed a day at the Hyæna Well to take observations, and by threats and cajoling induced the Mushakara boy to come on as far as the next watering-point; but he said, I think truthfully, that he did not know the way very well and had certainly never been beyond. So next day, seeing some encampments and hearing that there was no more pasture before reaching the Ifoghas hills, I decided to camp early in order to send Arab out to secure a guide from the local chief of the Mushakara and Ibatanata, another mixed tribe camped a few miles off. After hours of negotiation Arab returned, reporting a hostile reception and complete refusal to supply any guide. Khayar was so ashamed at having lost his way that his morale collapsed; he became entirely useless for the rest of the journey. We could not however leave him in this country, because we were now well out of the area of the Aïr Tuareg and he had no means of returning home alone. On the following morning the question therefore presented itself, whether to push on with Khayar and the Musha-

kara boy, who thought he could help for another 20 miles, and then with Khayar alone, for there would be no more pasture or camps whence we might procure another guide, or whether we should return on our tracks. We could not stay still because there was no water in the area; the grazing camps at this season were living on milk, which they could not afford to give us having nothing else to drink themselves. I decided to push on and risk securing a guide by force if necessary in the neighbourhood. So letting the caravan proceed, I set out with four armed men to raise trouble if necessary among the recalcitrant chiefs. However, I fell in with a delightful Ibatanata patriarch called Bani, living in Biblical surroundings in a group of three tents with his flocks and his children and his grandchildren. We got on so well that, instead of making any difficulties, he sent his younger son on one of his own camels to act as our guide. We regained the caravan some hours afterwards to find they were again heading off into space, thanks to Khayar having recovered his confidence enough to take the leading into his own hands, with lamentable results as far as direction was concerned.

Bani's boy was called Esh Sherif to commemorate the legendary but certainly spurious descent of the Arab side of his tribe from the People of the Prophet. He proved an excellent guide, though inclined to taciturnity and disconcertingly platitudinous replies which suggested that his questioner was mentally deficient. In spite of our short acquaintance, Bani and his family are as pleasant a memory as I have of this journey, and I sincerely hope I may have the fortune to see him again. I suppose we were very lucky on our journey west, and that it was all very interesting, but the aspect to which I now look back with most pleasure is certainly that of the friendships we made with the men who travelled with us. Arab was an outstanding character in every way: it is not too high praise to say that in quality of brain and manner he much resembled a particular friend of mine and noted geographer, Sir Ahmed Hassanein Pasha. In more fortunate circumstances, Arab might well have received a Balliol education and profited much therefrom. I hope he may yet benefit considerably from the instruction in reading and writing European characters which my brother took much trouble to give to this otherwise illiterate but very remarkable man. His qualities of leadership, his pure Tuareg descent from the late chief of the noble Ifadeyen tribe, and his wide travelling, were so notable that despite Tekhmedin's great difference of age and reputation as a guide, they got on very well together and left us firm friends.

The latter, faithful to his promise in 1922, came 150 miles on foot to me at Auderas as soon as he heard we had reached Aïr. Engaged originally for quite other purposes, he came west with us as head camel-man over a country he did not know. He at no time made any stipulation about reward, and declined a monthly salary: all he ever asked for was some money to keep his wife and family alive while he was away. When he finally reached the Niger he expressed his willingness to go wherever we wanted or to return home, and when the latter course was chosen as his way he inquired only how he should set about securing transport. When he was promised a camel as a present he observed that he had made no conditions. So we gave him the wherewithal to buy a second one as well, in the hope that he might be rehabilitated in the

dignity and respect which his position demands, but which his pride and principles would otherwise have precluded him from ever again securing in the conditions which obtain to-day in Aïr. Of how Ahmed left his family and possessions under the charge of his wife, to come with us on this long journey without warning or promise of reward, I have already spoken. We remember him as one of the greatest gentlemen it has ever been our good fortune to meet in any land. The others who accompanied us if less outstanding were pleasant and interesting. Saleh was an Arab from the Fezzan stranded by an evil fate at Iteruan; he was rather a vulgarian, but good company. Abdullahi came with us all the way from Katsina at the beginning of our journey. Mr. Palmer's servant and the boy Joseph we had sent back from Iferuan only because he was wanted by his master, but the other two boys, Ango and Saliu, came with us all the way to Dakar.

If I am inclined throughout to speak more of people than of things and places, it is frankly because they are more interesting to me. In these days of easy communications and perhaps consequently short-sighted if not actually unintelligent travel, there is too great a tendency to go abroad and return in a spirit mocking or critical of people living in other lands. "Humanas actiones non ridere, non lugere, neque detestari; sed intelligere," says Spinoza. The part of travellers is neither to deride nor praise nor blame, but to try and understand the people who live in other places. If those who travel near or far will take that as their text, they will find, as I have found, that even a race so blamed as the Tuareg has qualities which are worth knowing. Although they live in a manner differing vastly from our own, I have found them to have much in common with ourselves, much that was pleasant, and much that was more worthy of admiration than among many people nearer home.

Our journey to Kidal, with Esh Sherif as guide, passed uneventfully enough. From Tanekert well in an area of loose sand-dunes we crossed another completely desert zone called the Belly of the Negresses. Two days later the rock and pasture of the Ifoghas hills were reached. They were disappointing after the magnificence of Aïr. The low hills were mere outcrops of rock, though the wide gentle valleys at times took on good colouring of purple and orange. We did not appreciate the area as fully as we might have, realizing that the end of our journey was depressingly near. A sequence of grey skies, exceptional here at this time of year, and a few slight showers from the Mediterranean winter rainy season added to the distress occasioned by the biting cold wind. The temperature at night was constantly around 40° F. We made Kidal, a French post, having accomplished our journey in four days less than Khayar had said was normal for caravans. We had hoped here to find local men and some grain, but the harvest was late and no one was available, so we were forced to set out at once for the Niger. Ahmed, who badly wanted to return home, announced to all whom it might concern that no one could abandon us in a strange country until we found other means of transport than that for which he and the Aïr Tuareg were responsible to us. So we moved on, leaving the rock behind once more for a dull area of bush in the Tilemsi valley which used to collect the western Ahaggar rainfall and lead it into the Niger. It is an area of very deep wells, cattle nomads, and burr grass, not unlike Damergu only less pleasant. After six days we came suddenly upon

the river one evening at sunset, a brilliant expanse of blue, 2 miles wide between banks of yellow sand fringed by a wide border of vivid green rushes. The French post of Burem with its magnificent rest-house, village, and telegraph office marked the end of our journey. Ahmed and the party bound for Aïr departed a few hours after our arrival: they were acutely uncomfortable near so much water, and thought that they and their camels were sure to die if they delayed at all. Arab, Tekhmedin, and two others left a few days later for Kano, where we have since heard they arrived safely. During the whole of our journey I am glad to say we never had a single case of sickness or even serious indisposition either amongst ourselves or amongst any of our men except for one case of dysentery, which happily lasted only a few days. The worst that any of our men suffered from was overeating.

After selling our camels we left Burem for Timbuktu, whence a kindly French trader came to fetch us by motor boat. As it was still nearly high water in this reach of the Niger, we were delighted to be able to go by motor boat all the way up from Kabara, the port of the city on the river, to Timbuktu itself along the old canal dug in the fifteenth century by Sunni Ali, the great King of the Melle Empire. We spent four days at Christmastide in the city called The Mysterious; there was not much mystery but a great deal of interest at Timbuktu, where our stay was the most strenuous part of the trip, by reason of the overwhelming hospitality we met at the hands of the large French colony. The city, now much reduced, is very well worth visiting, as any enterprising tourist can do, for it may be reached in a very short time at the right seasons either by river steamer from rail-head at Bamako on the Dakar–Niger railway, or, since last winter, by the regular motor-car service of the Compagnie Trans-Saharienne from Algeria.

We found a great deal of valuable material about the Tuareg in the course of our journey west of the Niger and even at Timbuktu itself, but the bearing thereof would I am afraid only be interesting to the specialist. After more than ten years' work in such spare time as I have had available, I return to the two questions first asked. Who are the Tuareg? And why do they wear the Veil? I cannot say that I am appreciably much nearer a satisfactory answer than when I began to wonder. In contemplating the material accumulated it can be said that a few indications have perhaps been found about their origin. They are an old people, bearing markedly the traces of a fast-disappearing but higher civilization or mental development than they now possess. They differ from the majority of other Libyans in physique, mentality, and background. There are signs which point in remote antiquity to an extra-African origin or at least connection. I cannot say more than that here for fear of becoming controversial: indeed, even this is open to dispute.

Of their Veil and its source it is unfortunately possible to say even less, in fact, virtually nothing. The Tuareg seem for the most part at least, to have been unveiled until late in their history. I cannot tell why they adopted the veil or whence it came. I have listened to many theories, made some myself, and discarded them all as being not only still incapable of proof but mostly fanciful as well. One more fanciful than the rest is at least as plausible as any, if it is permitted to speak in metaphor. If not literally exact in objective reasoning there is a simile which satisfies those who understand the spirit of this

people. In the centuries during which they have been harried and have found the hands of all men turned against them, in all the years during which they have fought for their freedom, and especially their freedom of thought, they have preferred to conserve intact the ideal which they possessed rather than to surrender it for the flesh-pots of an easier life. In this time they have been driven to accept as practical, because necessary, many of those things which perhaps they realized were not perfect. Offer them to-day, in their age of degeneration, some ease of life or luxury as the price of spiritual freedom, and most of them will still refuse. They have their old ideals perhaps as a veiled and unconscious goal; something definite and real they still do keep. If their outlook is sad and their eyes seem to be for ever wandering away to a farther horizon their melancholy is not that of pessimism. It is merely that they are aware of something which is now beyond their power to achieve. These things will be apparent to those who have followed and understood what I have tried at various times to explain about the Tuareg. I hope that my figurative explanation of the Veil which is contained in a passage from Maeterlinck's 'White Ant,' will be at least as acceptable as some more prosaic reason founded on the most orthodox precepts of comparative anthropology. He writes of the eternal problem that "there are always at least two truths—one which is too exalted, too inhuman, too hopeless, and counsels only immobility and death; and another which, for all we know it to be less true, encourages us to Veil our Eyes—to walk straight ahead, to take an interest in existence, and to live as though the life we have to follow to the end shall lead us elsewhere than to the grave."

If the hard fate of history has prevented the Tuareg following the greater truth, their Veil symbolizes a journey upon the other road. They have bowed to inevitable circumstance but retained their ideal. It is that which explains why some of them have fallen away entirely and become unpleasant folk; it perhaps also explains why the rest of them conserve the traditions and bearing of what it is now old fashioned to describe as gentleman.

The technical appendices and lists of positions will follow in the next number of the Journal.

DISCUSSION

Before the paper the PRESIDENT (Col. Sir CHARLES CLOSE) said: The lecturer to-night, Mr. Francis Rodd, requires no introduction, and we know a great deal of the work he has done in the Southern Sahara. I understand that he began his acquaintance with the deserts of Northern Africa during the war; and then in 1922 he undertook an expedition to the Aïr country, and on his return gave us an account of the Tuareg. In 1927, accompanied by his brother Mr. Peter Rodd and Mr. Augustin Courtauld, he went north again from Katsina in Nigeria to the Aïr neighbourhood, and then almost due west to Timbuktu and the Niger. In the course of this further expedition he has learned still more of the Southern Tuareg. I will ask him to give us his account of them.

Mr. Francis Rodd then read the paper printed above, and a discussion followed.

Mr. AUGUSTIN COURTAULD: Before describing the wireless outfit I must apologize for the photographs which have been shown, which are not up to the usual standard of those seen by the Society, because the films were not sufficiently kept from the sun and were not developed on the spot. I would like also to say that the fact that during the expedition both the camels and the men

remained well was due entirely to Mr. Francis Rodd. Both suffered chiefly from septic sores, and iodine and permanganate of potash were found equally successful for them. Mr. Rodd said there had been no exciting incidents or thrills on the journey. Well, I think he is to be congratulated. We found the watering-places quite far enough apart without trying to get lost, but whenever we missed a well Mr. Rodd always knew of another somewhere.

With regard to the wireless set, made specially by the Marconi Company, it was a four-valve set only working on high wave-lengths so that we got no broadcasting. It worked very satisfactorily. Mr. Rodd drew the entire map of eighteen sheets, which is on a very large scale and entailed an incredible amount of work. We only helped him with the observations and traverses. All the staff work in preparation for our trip was also due to Rodd. We were provided with every useful tool and store that any one could think of, and there were few we did not use. It was due to this foresight that no untoward incident occurred. He has mentioned several minor things his brother and I did, but did not tell you of his own part. It was he who stayed up all night watering camels at the almost dry well of Tagedufat, and again who brought us successfully through a general strike of our camel staff. There are many of the simple people there who count the days to his return.

Mr. PETER RODD: Two Rodds in one evening may be regarded as an overdose, and there is nothing very much that I can add to what my brother has said, except to hope that he may have painted a sufficiently attractive portrait of Aïr to induce other people to go out there. We did not do a great deal we wanted to do. Besides much country left to be mapped, there is a language—that of the Southern Tuareg—to be rescued from oblivion. It is a Berber language, very fine and expressive. The literature is mainly oral, though there is a literature of verse and, I believe, one or two manuscripts. If any one goes out there in the near future, I hope the language will be a principal objective.

I should also like to refer to the hospitality we received from the French officers and traders everywhere. Their responsibility for our safety, which we were anxious to take on our own shoulders, must have weighed on their minds, but they were always polite and always hospitable. My brother has talked of my share in the commissariat. I do not think his gratitude would quite conceal his relief when we came into a French post and met a really good cook.

The PRESIDENT: I suppose we are all impressed with the fact that Mr. Francis Rodd and his companions were treated so well by the French authorities in the Southern Sahara. It is the same story as we heard when Mr. Cameron lectured to us a short time ago; and, on the other side, it is quite certain that Mr. Francis Rodd and his companions got on remarkably well with the Tuareg and the other indigenous people of the Southern Sahara. The geographical work that the party did has not actually been shown on the screen, except in those greatly reduced maps, but I can assure you it was remarkably good work. The astronomical observations and all the other work which together make a map have been brought back by Mr. Rodd in a form which has never been surpassed in recent years. The observations are clearly set down and the results can be followed by anybody, and that is not by any means always the case. This expedition was organized, one might say, for serious geography.

Such expeditions are gradually clearing up the waste spaces of the Earth, and we are very glad to have learned more about the Southern Sahara. The whole expedition was, undoubtedly, a great success, and in thanking Mr. Rodd and his companions for their work and the remarks they have made, and Mr. Rodd in particular for his lecture, I go away with an impression of the motto "Sore feet, but a fine view."

RECENT WORK ON THE PROBLEM OF LAKE MOERIS:

A paper read at the Meeting of the Society on 19 November 1928 by

MISS GERTRUDE CATON-THOMPSON
AND MISS E. W. GARDNER

1. *Introduction*

IT has been said that whoever works in the Faiyum is sooner or later drawn into the problem of Lake Moeris, that sheet of water famous in classical antiquity, and regarded by the modern Egyptian engineer as the earliest of the great irrigation works of the Nile Valley.

The Moeris problem may be outlined as follows: Herodotus, who visited Egypt about B.C. 450, states that he saw, filling the basin of the Faiyum depression, the waters of a great artificially controlled lake, receiving by means of an inlet channel inflow from the Nile at time of annual flood. When the Nile fell and the period of annual drought set in, the water stored in the great natural reservoir was discharged back into the thirsty valley by means of an outlet channel. This account has not in modern times received full credence, and many views, which require consideration, have been held with regard to the lake's extent and function. Our excuse for adding yet another lies in the fact that for the first time two essential aspects of the problem—the archæological and the geological—have been worked out in the field in close and continuous co-ordination. Moreover, our investigations have taken place in a neglected area north of the lake where desert conditions facilitate geological inquiry to an extent impossible on the heavily cultivated region to the south of it, and whence important new evidence has been obtained, not only bearing, as it seems to us, on the question, but introducing factors irreconcilable with prevalent beliefs.

Before passing on to examination of the historical evidence concerning Moeris, it may be as well for the benefit of any unfamiliar with the established view to quote an epitome from an authoritative and recently published textbook by Dr. E. Bevan:

"One of the greatest works executed under the second Ptolemy (B.C. 285–247) was the winning of large new tracts of land for cultivation and habitation in the Faiyum. This is the modern Arabic name for a depression, about 30 miles broad from north to south, and 40 miles long from east to west, which lies to the west of the Nile Valley, separated from it by a line of bordering hills. There is, however, a gap in these hills, near the modern El Lahun, through which a branch of the Nile, which wanders off westward near Assiut, can flow into the depression and fill it up to the level of the Nile. Hence in the days of the first Egyptian dynasties a great part of the depression presented the appearance of a natural lake, rising and falling with the river and having villages of Egyptian fisher-folk along its shores. Kings of the 12th dynasty took a great interest in this Lake Region; it became a favourite royal residence, and it was probably a king of this dynasty, concealed in Herodotus under the name 'Moeris,' who built the great dam with powerful locks across the gap, through which the river flowed into the depression, so regulating the inflow and outflow that the inhabitants of the depression would be secured against destructive floods and the country have a reservoir of water when the Nile was low. In the fifth century B.C. Herodotus visited and saw the great expanse

of water—Lake Moeris, the Greeks called it after his time. It filled the depression, in those days, up to about the site of the present capital of the province, Madinet el Faiyum, where there stood the Egyptian town of Shedet.

"When the Ptolemies took over Egypt the great lake was still there; but when the Greeks considered this fair and fertile country on the other side of the barren hills which bounded the Nile, it seemed to them possible to dry up a good part of the water in the depression and lay bare wide tracts of new, good soil for colonization. Greek engineering science, under Ptolemy I and Ptolemy II, took the work in hand, and in a few years, where there had been shortly before a sheet of water there were stretches of cornfields with new towns and villages. The water was reduced to less than half its previous extent, lying only over the northern and deepest part of the depression, where it still is to-day. Birket el Qarun became brackish and undrinkable owing to the effect of evaporation upon its shrunk volume. The word 'Faiyum' is an Arabic transcription of its Egyptian (Coptic) name meaning 'the Lake.' " *

The view of Lake Moeris represented by this quotation is founded upon the researches, some forty years ago, of Sir Hanbury Brown and Sir Flinders Petrie. These two authorities, whilst in agreement as to the existence of a great reservoir, seen by Herodotus, and reduced in volume to about its existing dimensions by a Ptolemaic king some two hundred years later, diverge sharply in their conceptions of its natural mechanism. In the graph (Folding plate) we show that Sir Hanbury Brown believed in a lake maintaining a uniform high level from prehistoric times, whilst Sir Flinders Petrie believes it to have gradually raised its level at a rate of $4\frac{1}{2}$ feet in a thousand years. Our field examination of the evidence for both these opinions, and our reasons for rejecting both, and substituting the oscillating line which relegates a high-level lake to prehistoric times alone, form the subject of this paper.

2. *Examination of the Historical Evidence*

It is unanimously held that Lake Moeris was situated in the Faiyum: the problem lies in the area occupied by it in antiquity, its relation to the Nile Valley, and the extent to which the classical tradition can be co-ordinated with scientific data gathered in the last century.

Of the early writers Herodotus is of paramount importance, for he relates that he saw Lake Moeris on his visit to Egypt about 450 B.C. Later classical writers—Strabo (Bk. XVII), Diodorus (Diodorus Siculus, Bk. I), and Pliny ('Nat. Hist.' Bk. V)—have but plagiarized his description of it, since they lived three or more centuries after the accepted date of its disappearance; these authors therefore, not being eye-witnesses, need not detain us.

It has become fashionable among scholars to confess belief in the veracity of Herodotus as an observer, whilst impugning his credulity in matters of hearsay. In regard to Lake Moeris, we shall propose a reversal of this judgment. The relevant passage (Herodotus, Bk. II, 149, Loeb Edition), after describing the Labyrinth, reads: "Such is the Labyrinth; and yet more marvellous is the Lake Moeris, by which it stands. This has a circuit of 3600 furlongs, which is as much as the whole seaboard of Egypt. Its length is from north to south; the deepest part has a depth of 50 fathoms. That it has been

*E. Bevan, 'History of the Ptolemaic Dynasty,' pp. 114, 115.

dug out and made by men's hands the lake shows for itself; for almost in the middle of it stand two pyramids, so built that 50 fathoms of each are below and 50 above the water; atop of each is a colossal stone figure seated on a throne. . . .

"The water of the lake is not natural (for the country here is exceedingly waterless), but brought by a canal from the Nile; six months it flows into the lake, and six back into the river. For the six months that it flows from the lake, the daily take of fish brings in a silver talent into the royal treasury, and twenty minæ for each day of the flow into the lake. Further, the people of the

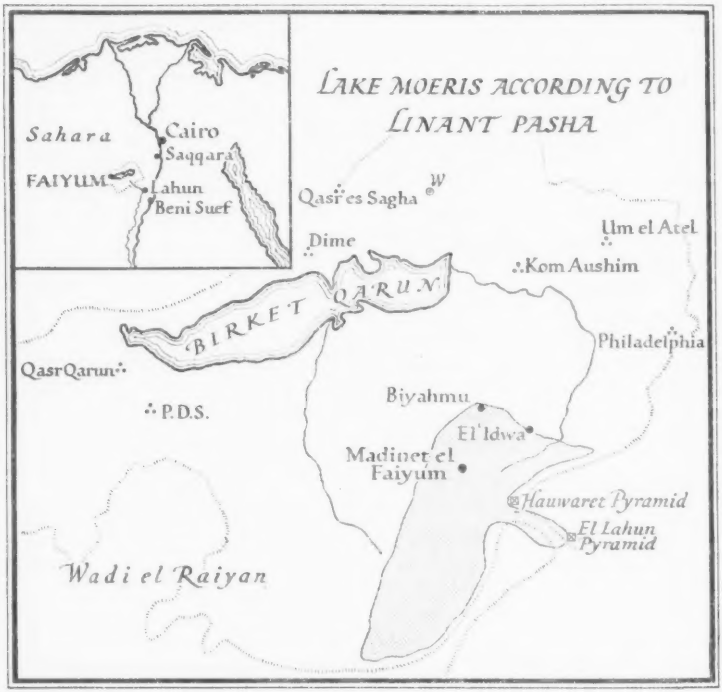


Figure 1

country said that this lake issues by an underground stream into the Libyan Syrtis, and stretches below the mountains that are above Memphis, having the inland country on its western side. I could not anywhere see the earth taken from the digging of this lake, and this giving me matter for thought, I asked those who dwelt nearest to the lake where the stuff was that had been dug out. They told me whither it had been carried, and I readily believed them, for I had heard of a like thing happening in the Assyrian city of Ninus. . . . The Egyptians bore the earth dug out by them to the Nile, to be caught and scattered (as was to be thought) by the river. Thus is this lake said to have been dug."

The general impression gathered from this is that Lake Moeris was a large artificial sheet of water occupying the greater part of the Faiyum, and serving as a reservoir for the surplus flood waters of the Nile. It is surprising, in view of the immense importance of such a reservoir, that there appears to be no ancient Egyptian literary evidence on the subject; the inferences to be drawn from the position of their monuments in the Faiyum will however in due course be considered.

We will next review the ideas propounded in the nineteenth century. First come those of Linant de Bellefonds Pasha,* who published his views in 1872

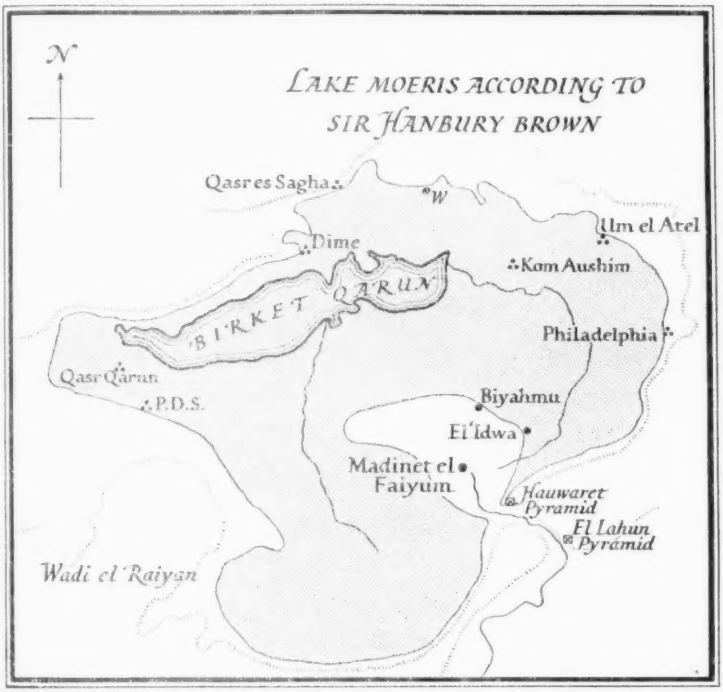


Figure 2

(Figure 1). He imagined that the area covered by Moeris was distinct from that of the Birket Qarun, and that it lay between the entrance channel of the Bahr Yusef at Hauwaret and the edge of the plateau on which Madinet el Faiyum, the capital, now stands. A prominent gravel ridge running east to west from Seila through El 'Idwa to Biyahmu was believed to be the artificial structure retaining the reservoir on this high ground. Linant seriously suggested that agriculture was practised on the perilous down slope outside the reservoir bank, between it and the Birket Qarun. Sir Hanbury Brown, who

*'Memoires sur les principaux traveaux d'utilité publique executés en Egypt depuis la plus haute antiquité jusqu'à nos jours, 1872–73,' chap. 11.

twenty years later found this view of the subject still current, gave it an overdue quietus by exposing its technical impossibility and the errors of level upon which it was based.

Schweinfurth travelled in the Faiyum in the years 1885–86*. His discovery of an ancient temple, known as Qasr-es-Sagha, situated just above the highest indications of lake deposits in the desert north of Birket Qarun, seemed to him weighty evidence in favour of a high-level Moeris, supported as it was both by the position and level of Dimai, a Græco-Roman town to the north of the lake, and of Biyahmu, a 12th-Dynasty site to the south of it.

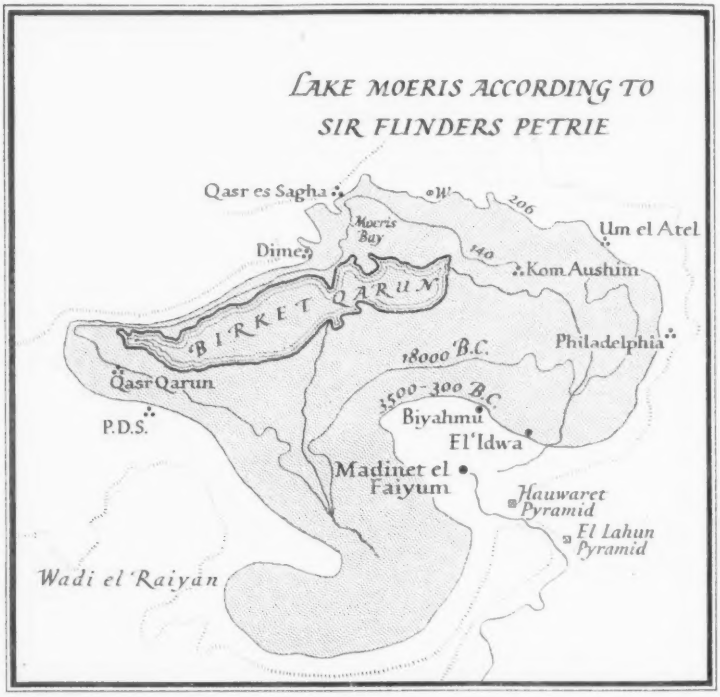


Figure 3

Cope Whitehouse † in 1890 believed Moeris to have been situated in the adjacent depression of the Wadi Rayan. This idea has been from the first shown to be untenable.

The theory of Sir Hanbury Brown,‡ Inspector-General of Irrigation in

*"Ein altes Heiligtum an den Ufern des Möris, 1895," *Illust. Deutsche Monatshefte*, p. 362. "Reise in das Depressionsgebiet im Umkreise des Fayum, 1886," *Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, Bd. 21, p. 144 (reprint, p. 49).

†Quoted by Hanbury Brown, pp. 40–48.

‡'The Fayum and Lake Moeris,' 1892.

1892, worked out from a careful consideration of level, etc., is that of a natural high-level lake, maintaining a more or less constant level from early times throughout dynastic history, its annual maximum being about 229 feet A.L.,* falling to about 210 feet A.L. at low Nile (Fig. 2, and graph on folding plate). A lake at this level would fill the entire depression, and Hanbury Brown believed it likely that in order to obtain more agricultural land, kings of the 12th Dynasty artificially restrained the lake level to the flood maximum of 219 feet A.L., and excluded its waters from inundating the highest-lying area required for cultivation and habitation by means of the same accommodating

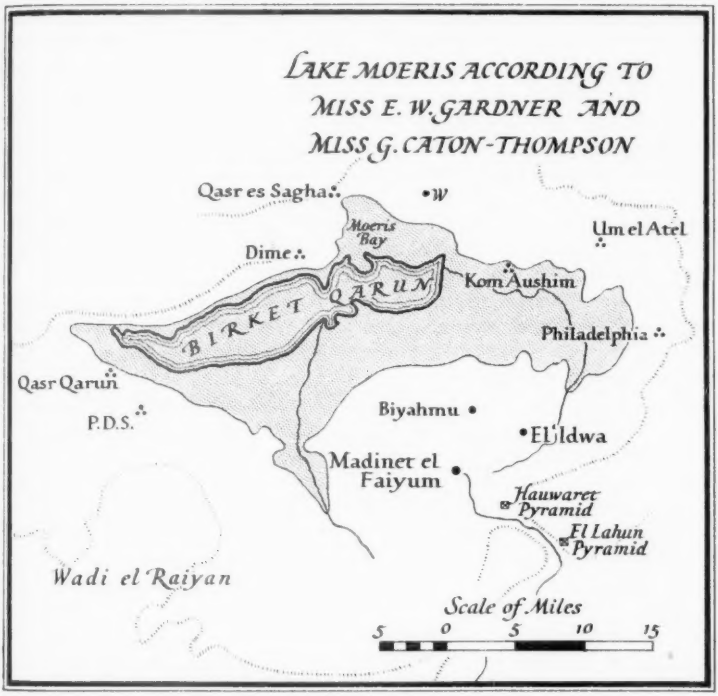


Figure 4

bank which Linant Pasha had invoked to retain *his* lake upon it. At high Nile the surplus water from the channel was supposed to escape by the Bats Drain, which Hanbury Brown considered to be of artificial origin; while, by means of regulators, part of the flood water was later returned for irrigation purposes to the Nile Valley.

Valuable as it is, Hanbury Brown's work on this subject is that primarily of the irrigation engineer, and ignores the necessary contributory data of geology.

*Heights are given in feet above level of the present lake (A.L=above lake), which stood at 147·19 feet below mean sea-level at Alexandria on 16 Dec. 1925.

In the present century, however, the first geological survey of the Faiyum by H. J. E. Beadnell* in 1905 seemed to confirm Hanbury Brown's views. Fresh-water deposits up to 219 feet A.L. were found covering a wide area of the Northern Faiyum desert. These were mapped, but not critically examined; the lake was considered prehistoric in age, lasting down from Pleistocene times till the Ptolemaic period, when it was artificially reduced by check of inflow. This view, as we shall hope to show, would not have been possible had the character and fauna of the various lacustrine deposits been investigated.

Sir William Willcocks† accepts Hanbury Brown's ideas as proven, his belief in them being strengthened by his discovery in the Faiyum on the desert slopes of a belt of Nile shells which he found to lie at 222 feet A.L. "Here were the limits of ancient Lake Moeris."

A modification of all these views has been urged by Sir Flinders Petrie. Relying on the evidence for the steady silting of the Nile Valley throughout historic times, estimated in Middle Egypt as 4½ feet per thousand years, he regards the Faiyum lake as having gradually risen in harmony with the corresponding rise of the Nile channel, with which it is connected by the Bahr Yusef (Fig. 3, and graph on folding plate). "The first stage of interference with nature here seems to have been under Amenemhat 1st . . . then under Amenemhat 3rd came the great extension of this damming out system; and by means of a vast embankment some 20 miles in length an almost level area of about 40 square miles, or over 20,000 acres, was secured from the lake, and became one of the most fertile provinces of the country. On the prominent northern corner of this great work (now known as Biyahmu) were placed two massive platforms of stone walling, filled in with earth, from which arose two seated colossi of the king. These were monoliths about 39 feet high, placed upon pedestals. . . . These were doubtless the statues and pyramids seen by Herodotus. The work of Amenemhat was not only the reclaiming of all this land, but also the regulation of the flow of the Nile in and out of the lake. Down to the time of Herodotus this annual flow continued, and the lake served to hold part of the surplus of the high Nile, and to let that flow out again during the low Nile."‡ Sir Flinders Petrie finds archæological support for his theory in the position of certain dynastic monuments within the basin, the most crucial being the Biyahmu Colossi. Another building used by Petrie as evidence of a high-level lake is a so-called "quay" at the Græco-Roman town of Dimai on the north side of the lake. The evidence will be critically examined in the archæological section of this paper (pp. 36–51).

Quite recently Monsieur Hug§ of the University of Cairo has claimed the historic lake at 206 feet A.L., but as no evidence is given for this opinion it need not detain us.

Our own view, resulting from the collection of fresh data unknown to our predecessors, is at variance, as will be seen, with all the foregoing hypotheses.

*"Topography and Geology of the Fayum Province' (Cairo, 1905), pp. 79–84.

†'From the Garden of Eden to the Crossing of Jordan ' (Cairo, 1918), chap. iii, pp. 33–48.

‡'History of Egypt,' vol. 1, p. 201.

§"Le Moeris. Etude de Géographie Physique Historique," *Bull. Soc. Roy. de Géographie d'Egypte*, T. XV, 1927.

We believe that the historic Lake Moeris was a low-level lake, never exceeding a height of 140 feet A.L., thus occupying the deepest part of the depression, with a big gulf stretching northward towards Qasr-es-Sagha in Moeris Bay (Fig. 4, and graph on folding plate). Further, we consider that *there was never a high-level lake in the Faiyum in historic times*, although a series of prehistoric lacustrine levels have been identified.

3. *Geographical Features*

Various physical features of the Faiyum have been referred to in the preceding section, but before the above hypotheses can be discussed, it is necessary that the configuration of the province should be clearly understood.

The Faiyum Basin is the most easterly of a great series of depressions stretching east and west across North Africa, including in its course the Siwa group and the newly discovered Qattara Depression. It is bounded on all sides by hills and escarpments, which are broken deeply only in one place on the southern side, where the Bahr Yusef, a branch of the Nile, taking off from the main river at Assiut, enters the Faiyum channel at Lahun and emerges into the depression itself at Hauwaret some 12 miles west of Lahun. From here the waters are led in all directions by canals, and after irrigating the entire province, fall at last into the Birket Qarun, a brackish-water lake some 25 miles long by 5 wide, which lies in the deepest part of the depression at 147 feet below sea-level.

The desert to the north of the lake was little known owing to the difficulties of working there far from drinking water. The heights of two points only in the more westerly part were fixed—that of the temple at Qasr-es-Sagha—Middle Kingdom in age, or perhaps even older—lying at the foot of the northern escarpment at 262 feet A.L.; and the Græco-Roman town of Dimai at 229 feet A.L., 4 miles to the south, near the edge of a lower escarpment overlooking the lake.

One of our first duties, therefore, was to obtain a fuller knowledge of the configuration of this region. Level lines were run from the lake, whose height was ascertained from the Irrigation Department, to all sites of archæological importance and to any other necessary points, the ground being contoured at 10-foot intervals.

The results of this work were of great interest, for heretofore an inferential argument in favour of a high-level—222 feet A.L.—Moeris was the necessity of supplying water to Qasr-es-Sagha temple and settlement at a level of 262 feet A.L. Our levelling shows that to effect this, water at 222 feet A.L. is entirely unnecessary, for a great depression runs north from the present lake, dividing the higher ground into an eastern and western plateau (Folding plate: general map). The bottom of this depression we found to be well below sea-level, and the configuration of the ground is such that a lake as low as 140 feet A.L. would, at its north-western extremity, come within half a mile of Qasr-es-Sagha. This depression, which we named Moeris Bay, is therefore of importance in the consideration of historic levels.

The east and west plateaux lie at an average elevation of 180 feet A.L. At the southern edge the ground falls abruptly to the Birket Qarun, while to the north the general even slope of the surface is broken by a series of irregular-

shaped basins containing more or less vegetation on their floors, which for the most part lie at sea-level or 6 to 10 feet below it. In these depressions rain collects and remains for a short period after storms, the damp ground being later cultivated by the Bedawi coming up from the villages bordering the lake.

To the north of the western plateau the ground rises steeply in a series of steps to the level of the Sahara; while on the eastern side the bordering cliffs lie farther away, the intervening area being occupied by an extensive gravel plain.

This northern desert is described in some detail, partly because of the previous lack of information concerning it, and partly because it was in this area that our new evidence was obtained.

The region to the south of the lake has been fully contoured by the Egyptian Survey, and only its most important characteristics need be discussed. Of these we will give first the levels along the Lahun–Hauwaret channel, which range from 239 feet A.L. at Lahun to 226 feet A.L. at Hauwaret. On either side of the Bahr Yusef cultivation spreads up to the desert edge, forming a belt some 1400 yards wide. The surface material appears to be Nile mud, the depth of which is unknown. While mud is the predominating material on the surface, both on the Madinet plateau and in the Nile Valley, it is too often assumed that the same material is continued down to an indefinite depth. This, however, is not the case. Borings at Madinet-el-Faiyum and near 'Idwa show that sands and gravels predominate at greater depths, while in the Nile Valley the average thickness of mud is given as between 30 to 35 feet, underlain by sands and gravels to an indefinite depth. Since the theories based on rate of accumulation take account of the mud only, calculation based on this, supposing the rate to be constant, would take the record back but 9000 years at the outside.

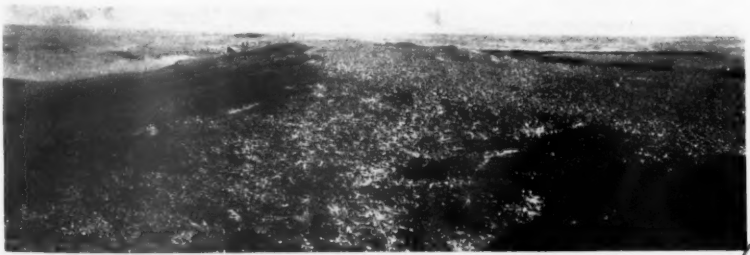
From Hauwaret a plateau 8 miles long by 7 wide stretches out to Madinet-el-Faiyum. It is roughly semicircular in shape and has an average elevation of 222 feet A.L. To the north-west the land falls gradually to 180 feet A.L., where a more abrupt slope leads down to the lake. To the north-east and north there are two fairly well-defined steps—the first at the edge of the 222-feet A.L. plateau, the second at 160 feet A.L. as before. Nearly the whole of this area is under cultivation, and is drained by two conspicuous channels—the Bats on the east, and the El Wadi or Nazla Drain on the west. The parts not under cultivation are isolated sandy and gravelly areas, whose distribution is shown on the map. The most important of these has already been mentioned as serving as a boundary embankment to Linant's, Hanbury Brown's, and Petrie's lake. It is known as the 'Idwa Bank, and must be considered in detail since it has been used as one of the main archæological arguments for the existence of a Lake Moeris at 222 feet A.L. (Pl. 1, No. 1).

There is a fundamental divergence of opinion on the nature of the bank. Contrary to the belief of archæologists, all geologists who have seen it—from Schweinfurth* onwards—regard it without hesitation as natural, a view with which, after careful investigation at many points, we entirely agree. It is, to

*'Reise in das Depressionsgebiet im Umkreise des Fayum,' p. 134 (reprint, p. 39 (footnote): M. Blanckenhorn, 'Geologie Ægyptens' (Pl. I–IV), *Zeit. Deut. Geol. Gesell.*, 53, 1901, p. 444.

1. The Bats Drain in the middle distance, with the Idwa Bank beyond

2. Sands and gravels of the Idwa Bank: the steeper slope is to the north



Wadi

3. Wadi at West end of Birket Qarun cutting isolated ridge of 222-foot lake deposits: Tertiary scarp in background

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4. Eroded terrace of 222-foot lake beds below Qasr-es-Sagha: Moeris Bay in the distance

5 and 6. Late Neolithic-Historic beach at 140 feet A.L. west of Dimai, and its relation to the Birket Qarun

begin with, well bedded, not only at the base, but throughout; moreover, current action is clearly indicated in the sorting of the constituents according to size. Further, there is in places a well-developed molluscan fauna, which not only occurs in a perfectly normal manner, but shows well-defined characteristic assemblages in the different strata. These assemblages have been traced by us in other parts of the Faiyum. We consider the 'Idwa Bank as of composite origin. The lowest beds are argillaceous and are to be regarded as the deeper water equivalents of the oldest beach deposits of a 278-feet A.L. Pleistocene lake, whose existence was discovered in 1926. These are followed by a complicated series of sands and gravels, which mark a pause at 222 feet in the fall of this high-level lake, modified at a later date by the wave action of a Neolithic sheet of water (Pl. 1, No. 2).

The Bats ravine cuts through the bank 2½ miles east of 'Idwa. The top of the bank is here some 219 feet A.L., and it consists of 27 feet of coarse gravel and sand underlain by 7 to 8 feet of lacustrine clay. From the base of the clay to the bottom of the ravine at 153 feet A.L. Tertiary beds form steep cliffs some 30 feet high (Pl. 1, No. 1). The Bats is then deeply entrenched along the greater part of its course, the Tertiary floor lying in the neighbourhood of the bank between 190 feet and 196 feet A.L.

All these facts seem to us to show conclusively the natural origin of the 'Idwa Bank. Hanbury Brown, not finding any spoil ditch on the outer side from which the material could have been obtained, assumed that it had all been transferred from the desert edge to the east. Had this been the case, would the supposed builders have carefully graded the pebbles, or taken care to preserve the faunal assemblages? It is still more difficult to understand why material for a retaining bank so unsuitable as sand and gravel should have been transported from a distance, when an unlimited supply of impermeable Tertiary and Pleistocene clays lie temptingly exposed close at hand in the Bats section.

Again there is a great discrepancy between the actual course of the bank as shown on the Survey maps, and that given by Hanbury Brown on pages 73 and 75 of his book. He makes the bank turn abruptly south just east of 'Idwa, and shows the Bats Drain spreading out between it and the eastern desert edge (Fig. 5). The most cursory examination either of the ground or of the map shows that this is not the case. The line of the bank is as distinct and continuous to the east of the Bats as it is to the west; moreover, although the coarsest gravel forms a distinct ridge, it is not an isolated area of high ground, but merely the northern limit of the 222-feet A.L. plateau. As is clear from the map, sands and gravels occur at many points in this region, quite unconnected with the "Bank," and also outside it at lower levels.

The inadequacy of Hanbury Brown's data is shown on his own map (Fig. 5), where the embankment which should keep Moeris from flooding the 222-feet A.L. plateau from the south-west is represented by a dotted line and question marks.

Another postulate of Hanbury Brown's which we cannot accept is that of the nature of the Bats Drain. He regards it as an artificial overflow channel. On this view the part north of the bank could only have developed since Ptolemaic times, for he has averred that previously all this region was occupied by the

222-feet A.L. lake. Even granting that the controlled water may have followed a pre-existing natural course, we should yet expect some marked change in character between the old portion to the south, dating back about 4000 years, and the relatively new channel to the north of the 'Idwa Bank, nearly 2000 years later. Of this there is no sign at all; the ravine in which the Bats meanders maintains its breadth of about a quarter of a mile in both parts, neither is there a change in the fall of the bed at the supposed junction of drain and lake, such as would be expected as a result of the rapid artificial lowering of the level. One further fact may be mentioned, namely that the sides of the ravine both above and below the bank are made up partly of lake beds, partly of Tertiary: there is no abrupt change either of facies or fauna as should occur if Hanbury Brown's view of the channel is correct. We may

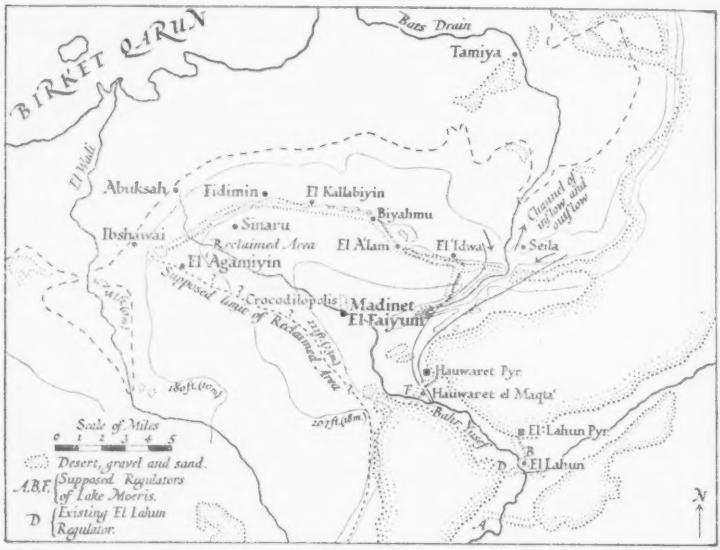


Figure 5. Area reclaimed from Lake Moeris by artificial embankments and regulators (line in shorter pecks), according to Hambury Brown (Plate XXI, p. 75, op. cit.), and actual distribution of natural gravel banks (dotted areas)

claim, we think, to have put forward enough positive points to prove our contention of the natural origin of both the 'Idwa Bank and the Bats Drain.

A further argument used by Hanbury Brown to support his theory is supplied by the levels at which sites of various ages are found. He points out, and this view has been emphasized by Petrie and other archæologists, that the buildings of the early historic periods are not found at low levels, while those of later times, Ptolemaic and Roman, may range from the highest to the lowest, inferring that their position is controlled by lake level. Now this is correct with regard to the historic buildings of the Faiyum, but the inference drawn from it need not be so, for there are other conditions beside that of lake level which influence choice of site. The argument might, perhaps, be applied

with some success to an isolated oasis-lake such as existed at Kharga Oasis, but it must not be forgotten that the southern Faiyum plateau, where nearly all the earliest monuments and towns lie, has Nile water to irrigate it, and is—and probably always was—quite independent of any lake supply. We would suggest that the rich black mud of the 222-feet A.L. plateau, watered from the Bahr Yusef, and easy of access from the Nile Valley would obviously be the most agriculturally desirable area, and, therefore, the region first and most densely inhabited within the basin. Upon it we find the old 12th Dynasty (or older) capital, Shedet (Crocodilopolis). There is no reason to assume that its position was any more controlled by lake level than it was in Ptolemaic times, when the lake was certainly miles away, and Arsinoe flourished on the same spot; or than to-day, when Madinet-el-Faiyum maintains the old prestige. On the negative side, therefore, the assumed absence of dynastic sites in the Faiyum below the Nile level of their period does not seem to us a weighty argument: in any case its application to the Faiyum is now ruled out by our discovery of early dynastic settlements at a low level.

All previous investigators, Hanbury Brown included, have found support for their views in the supposed maximum limit of lake deposit at about 222 feet A.L., the required Moeris level, higher deposits having escaped detection. In 1926 we discovered lacustrine beds up to 278 feet A.L.; thus a new element is introduced into the argument, and it can now be shown that the 222-feet A.L. lake was but a prehistoric member of a series. The geological evidence for this, together with that affecting Professor Petrie's idea of a steadily rising lake, will be considered when that aspect of the subject is dealt with (pp.32–6). Suffice it to say here, that two diametrically opposite views of the Hauwarat channel are taken by Sir Flinders Petrie and Sir Hanbury Brown. Hanbury Brown found a rock sill near the village of Hauwaret at 210 feet A.L., and since it was sloping in the direction of the channel, he assumed that it was present beneath the surface there at about 206 feet A.L. He states this in the text (p. 92), but in his section (p. 98) he shows the sill on the side, but not beneath it. Sir Flinders Petrie, on the other hand, considers that the Nile was in free communication with the Faiyum from the earliest times, and on this view therefore no barrier at 206 feet A.L. could exist. The question as to the height of Moeris is not materially affected by this point, since the Nile had in all probability raised its bed to this level before historic times, and we do not therefore propose further to consider this sill. We know that the Bahr Yusef is now running on an artificial rock channel near Hauwaret at 216 feet A.L., but this tells us nothing as to the presence of rock in the abandoned, natural course to the east, which is now too heavily cultivated to be investigated.

Having summarized and commented upon the various earlier hypotheses of Lake Moeris, we will give the results of our own work. But before doing so we would like to emphasize the points that seem of most importance to us in the above discussion. These are:

Firstly, that the presence of low-lying ground to within half a mile of Qasr-es-Sagha invalidates the argument for a high-level lake based on the height of the temple at 262 feet A.L.

Secondly, that it is necessary to consider other reasons for the location of sites besides that of lake level, and that therefore unless there is direct evidence

of the existence of a port, the mere position of a town does not necessarily give any clue to the lake-level of the period. We might here mention that Grenfell and Hunt ('Some Fayum Towns and their Papyri,' p. 7), believing in a high-level Moeris, expected, but could not find, a port at Umm-el-Atel, and were puzzled by its absence.

And finally, that any hope of a true solution of the problem must rest on a consideration of *all* of the three main aspects—namely, geological, archæological, and irrigation engineering. Of these we would like to emphasize the importance of geology and palæontology, which heretofore have been ignored. The presence of lakes and their various changes of level is essentially a problem in physical geology and geography.

4. *The Geological Evidence*

We have tried in the first part of this paper to show that much of the evidence on which the existence of a high-level historic lake is based is either inconclusive or capable of another interpretation.

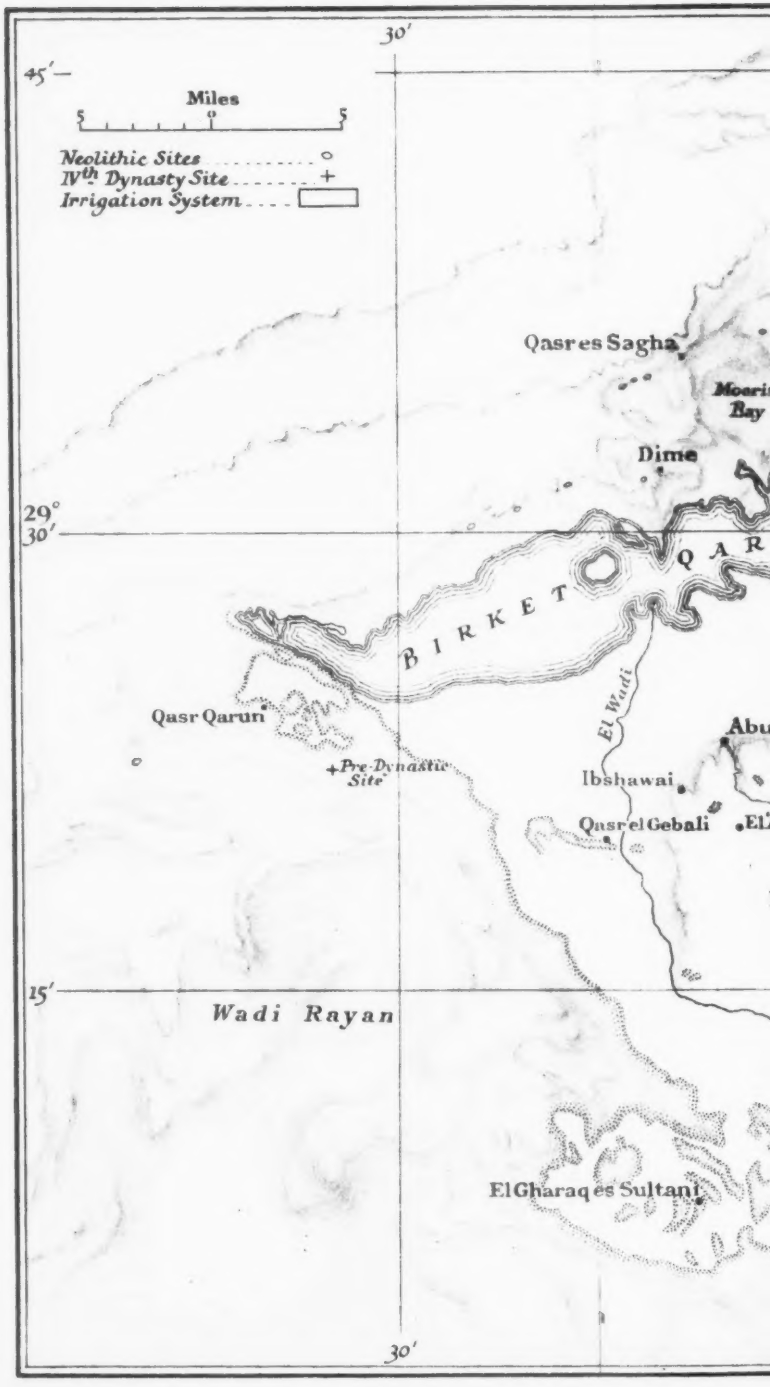
We have already stated the conclusions reached by us from a study of the Northern Faiyum. The evidence can be divided into geological and archæological; we will first deal with the geological, discussing at the same time the bearing it has on both Beadnell's and Petrie's views.

As the result of a preliminary season's archæological work on the flint industry of Neolithic type peculiar to the Faiyum (see p. 37, 41), it was realized that the movements and settlements of the makers of these implements were controlled by a lake *below* the accepted 222-feet A.L. level; moreover, it was concluded from archæological evidence that they were living by a falling water-level.

With this report Sir Flinders Petrie could not agree. It was therefore decided to try to settle the matter from geological data, and one of us spent all the next season working out the recent geology and accurate levels of archæological sites. It is our concern to place on record such facts as we observed and repeatedly tested, without reference to their confirmation or contradiction of our general thesis. The whole subject of the control of lake levels in the Faiyum is charged with complications arising from the fusion, or confusion, of two main factors—the climatic changes in the Faiyum itself, and the degree of communication with the Nile.

In an oasis isolated from contact with an inflow of Nile waters any observed change in lacustrine level may be attributed, with some security, primarily to variation in climatic conditions. We have reason to suppose that at certain periods free communication with the Nile was interrupted and the Faiyum lake must then have responded only to variations in rainfall and evaporation. When free flow was established the Nile levels would become the predominating factor, modified to a certain extent by climatic influences. It is in these periods that it is particularly difficult to disentangle one factor from the other.

(*a*) *The Pleistocene Lake.*—From the onset it was apparent that the problem was not confined to changes of level of a single lake, but involved the investigation of several sheets of water. Lacustrine deposits were found up to a height of 278 feet A.L. far in excess of those hitherto known, showing upon what insufficient evidence the geological arguments had hitherto rested. Strati-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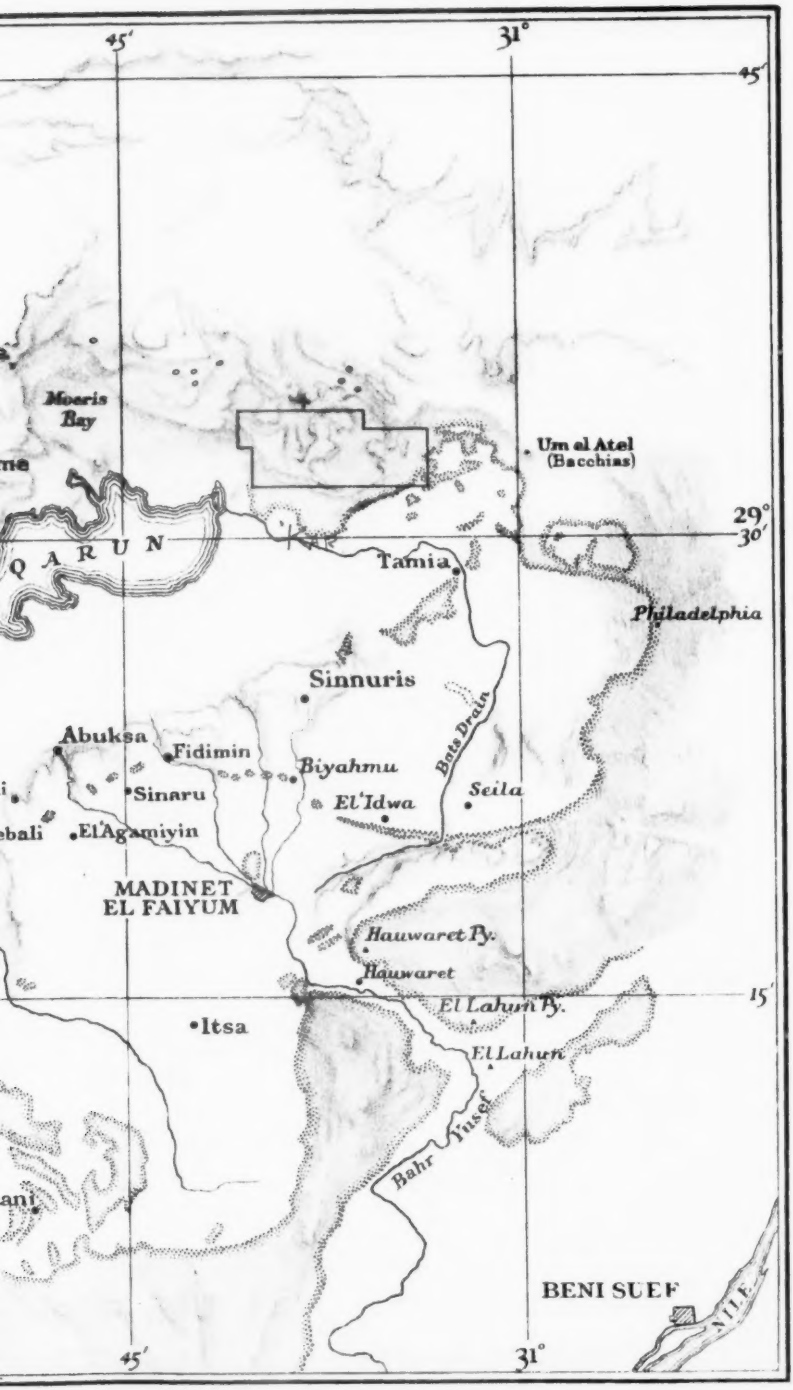


THE FAIYUM DEPRESSION

CATON-THOMPSON AND GARDNER

graphical and palæontological evidence shows that this 278-feet lake fell to 222 feet A.L., at which stage a well-developed beach found in certain areas indicates a pause of considerable duration.

The most important conclusion reached was that the 222-feet lake—the reputed Moeris—was of very ancient (Pleistocene) origin, and that it had dried up and its deposits been eroded long *before* the advent of the Neolithic people. A paper on the geological evidence was published in the *Geological Magazine* for September 1927. To this we would refer those who may care to study the details; here we will give the main facts only on which our inferences are based.

In the first place, though the deposits of the 222-feet lake were found locally well developed—notably below the scarp on which Qasr-es-Sagha stands—their condition did not suggest a geologically recent withdrawal of the lake. The climate of Egypt since the supposed reduction of the water-level in Ptolemaic times has probably been much the same as at present, yet the deposits are deeply eroded by water action and thickly covered with large and small rock fragments washed down from the neighbouring cliffs (Pl. 3, No. 7). It may be said that the occasional heavy rains which still fall in the desert are enough to account for this, working on a steep slope over a period of 2000 years. But there are wadis at the west end of the lake to which this explanation is not applicable, since they rise on gently sloping ground, and cut through deposits of the 222-feet lake, which have long been left as isolated ridges standing out 15 to 20 feet above the surrounding country (Pl. 1, No. 3). The drainage here is then quite certainly not in that immature stage of development in relation to the 222-feet lake expected on the hypothesis of a recent high-level Moeris.

Further, at Qasr-es-Sagha the 222-feet A.L. deposits which form a terrace below the temple, terminate abruptly in a conspicuous cliff, which is obviously an erosional feature (Pl. 2, No. 4). The thickness of these beds is here some 40 feet, and the dip a gentle southerly one. It follows, therefore, that these beds once extended a considerable distance farther south, since the original profile of a beach deposit is that of a platform terminating in a slope of some 45°—not in a vertical cliff—with a corresponding steepening of the dip of the beds towards the increased slope (Fig. 6). Had the lake been of such recent origin, we should have expected the original profile to be preserved in between the wadis in areas such as Qasr-es-Sagha, sheltered from the prevailing north-westerly winds. Yet in this part, over a distance of some 3 miles, no such profile can be found; these deposits are indeed of sufficient antiquity for more than 32 vertical feet to have been completely removed over very wide areas, leaving only isolated groups of hillocks. Erosion on this great scale cannot have taken place, as existing belief implies, within the last 2000 years, but must date back to Pleistocene times. Nor is it conceivable that any later rise of lake attained the same high level. Confining ourselves here solely to geological reasoning, had it done so traces of deposits lying unconformably upon, and against, the old eroded series, together with a more recent molluscan fauna, would be present. We can state with the certainty of long, methodical, and detailed inquiry that no such later high-level deposits exist, and in this matter archæology too speaks with no uncertain voice, for the Neolithic

flint-users were living by a lower lake which had an entirely separate identity from the older 222-feet A.L. level.

(*b*) *The Neolithic Lake*.—Geological evidence was forthcoming for the existence of this sheet of water. At about 206 feet A.L. there is in some parts a fairly well-defined terrace of white sands, overlying the harder, greener beds of the older series, and therefore younger. The newer beds are associated with a fauna which is quite distinct in its general assemblage from that of the older lake, though there are forms common to both. Further, this newer assemblage has not been found above 206 feet A.L., the fauna of the higher levels always agreeing with that of the 222-feet lake. The great break that occurred at this period is brought out by the difference in the faunal assemblage of the lowest known levels of the 222-feet lake, and that of the Neolithic. In an isolated gravel bank at Tamieh at sea-level (147 feet A.L.), and for some feet below it, a fauna was discovered which can only be regarded as representing the effects of desiccation on the shrinking lake. Though individuals are numerous, there is a marked falling off in the number of species as compared with the higher levels; certain types show abnormalities of growth which are to be attributed to adverse conditions; and finally, a brackish water form appears in abundance.

The Neolithic assemblage, on the other hand, is characterized by numerous species as well as individuals; these without exception are entirely freshwater, and typically Nilotic in type.

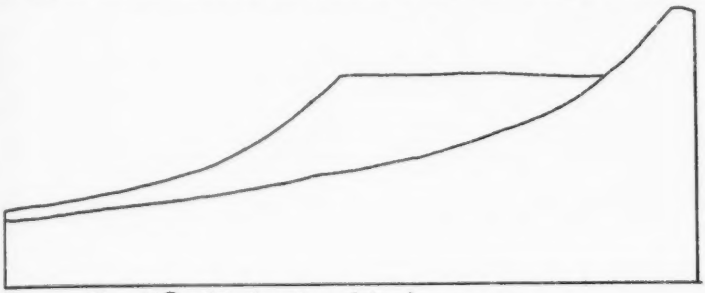
Archæological evidence shows that the newer 206-feet A.L. lake, which we have called the Neolithic, had already fallen from this maximum to about 180 feet A.L. before the main Faiyum settlements were established. We consider that it was this falling sheet of water which in its final stages gave rise to the historic Lake Moeris at not more than 140 feet above the present lake-level.

(*c*) *The Late Neolithic-Historic Lake*.—The geological evidence for this is found in the existence of a well-defined beach at this 140-feet A.L. level, which is preserved wherever there is sufficient shelter (Pl. 2, Nos. 5, 6). It shows the ideal beach profile, and in this respect is in sharp contrast to the 222-feet cliff at Qasr-es-Sagha. Comparing the profile of the 140-feet beach with that of the perfect theoretic beach as given by D. W. Johnson in his 'Shore Processes and Shoreline Development,' it will be seen how closely the two agree (Pl. 6). Moreover, the deposits forming the beach dip at a steep angle towards the slope of the profile, thus showing that this is an original line, not one of erosion.

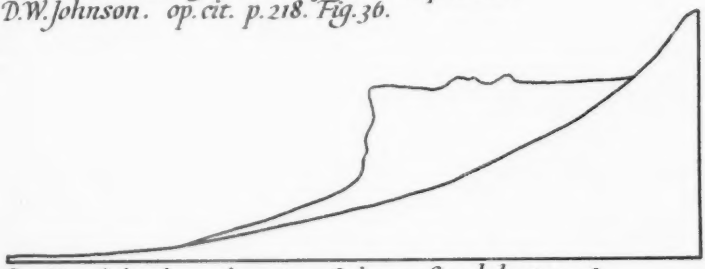
The fauna associated with this beach is rich in individuals but poor in species, compared with that of the higher levels of the Neolithic lake; it is also, on the whole, definitely less weathered in appearance.

Another indication of the recent date of this shore-line is the very constant presence along it of tamarisk stumps and bases of modern reed stems (Pl. 3, No. 8). The latter have not been found above 152 feet A.L., and then only around the outer edge of the escarpment bordering the lake, never in the basins on the plateaux. The shore-line of the Neolithic lake is also marked by a line of vegetation, but in this case calcification has taken place, both in the tree-stumps and the reeds (Pl. 3, No. 9). Had the 140-feet level been the oldest

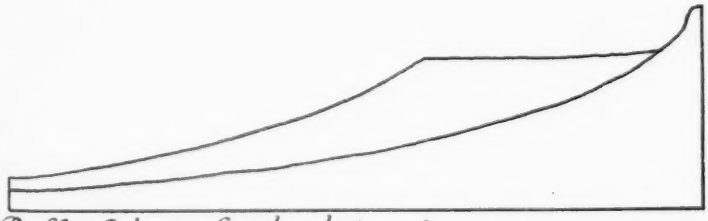
of the lakes, we should have expected the plant remains along its banks to have been in a similar calcified state. Moreover, it is impossible to believe that the perfection of the beach profile would have been preserved if this line is the most ancient, as according to Professor Petrie's theory it should be. Had it been formed before the 222-feet lake, or even before the 206-feet one,



Mature Beach Profile developed in deep water
D.W. Johnson. op. cit. p. 218. Fig. 36.



Profile of the shore deposits of the 222 foot lake (23 m.)



Profile of the 140 foot beach (-2 m.)

Figure 6. Beach profiles

the erosion produced by the falling sheet of water must inevitably have destroyed its outline.

The attainment of such a perfect beach profile not only shows the absence of disturbance by water since its formation, but requires a considerable period of time, together with a fairly constant water-level. Further geological evi-

dence for the stability and recent origin of this lake is shown by the presence of a wadi at the north-western end of the Birket Qarun, which cuts through the older lake deposits to the 140-feet A.L. level (Pl. 6, No. 16). Not only was the wadi cut to this level, which might have been a rapid process in such soft material, but it was also filled up with coarse detrital deposit. These deposits, which are harder than the surrounding lake beds, have themselves been greatly eroded and stand out in isolated pinnacles. The fact that no trace of lacustrine material was found interbedded with the wadi-wash, shows that the wadi was cut to a stationary, not to a rising, lake, since in the latter case some trace of its deposits would be expected either banked up against, or interbedded with, the wadi-wash in the channel itself.

From the geological facts outlined above, we hope to have established the following inferences:

(1) That while the supposed Moeris level of 222-feet A.L. certainly exists, it is not of historic date, but a far older Pleistocene sheet of water, which disappeared not only long before the dynastic, but even long before the predynastic period.

(2) That this 222-feet level was never reached again in later times by lake water.

(3) That the most recent level is at 140 feet above the present lake, and that this was the shrunken remnant of a lake attaining its maximum of only 206 feet A.L. prior to Neolithic times.

5. *The Archæological Evidence.* i. *Prehistoric*

The Faiyum has long been known to be the centre of a beautiful and varied flint industry of obscure origin. Explorers of the desert north of the lake, about twenty-five to thirty years ago, Seton Karr (*Annales du Service des Antiquités*, Tome V), H. J. E. Beadnell (*Geological Magazine*, 1903), and C. W. Andrews had reported the implements as surface finds fringing lacustrine deposits: but had not stayed to investigate their provenance or connections more closely: nor had a particle of evidence proving their period been obtained. To a prehistorian, studying the Faiyum industry in museum collections, it was obvious that a mixture of flints of several ages was represented in these desert sweepings.

This, then, was the motive of research when one of us in 1924–5 spent some weeks in the northern desert on behalf of the British School of Archæology in Egypt.

(*a*) *Neolithic Settlements on Pleistocene deposits.*—Prehistoric settlements, the discovery of which was essential for analysis of associated groups of objects, were identified, and five out of six were found to lie between 190 and 195 feet (Figs. 7, 8) above present lake. Chipped flint tools, polished and ground axes, pottery, evidence of agriculture, domesticated animals, and other items of Neolithic status were obtained *in situ* from middens. The settlements showed no sign of subsequent immersion, and this fact combined with a scatter of similar implements and pottery at yet lower levels gave strong presumptive evidence in favour of a lake falling at that period. Incidentally it became apparent (a minor issue it then seemed in the midst of burning questions regarding this discovery of a new prehistoric culture) that the level

7. Eroded and rock-strewn terrace of 222-foot lake beds, north-west end of Birket Qarun

8. Unaltered tamarisk stumps and roots in the 140-foot beach

9. Calcified stumps and roots along the Neolithic shore-line at 206 feet A.L.

10. Sand-rock hillock of 222-foot deposits, which sheltered Neolithic people
Hillock

11. "L"-shaped stone-faced hillock of lacustrine sand-rock, south-west of Qasr-es-Sagha

12. Biyahmu pedestal of statue of Amenemhat III and girdle wall

of historic Moeris at 222 feet, as accepted by archæologists with the geological benediction of Beadnell (p. 82), was directly implicated. Sir Flinders Petrie, however, maintained his belief in the Solutrean (Upper Palæolithic) age of the discoveries, finding it impossible to reconcile these new observations with his idea of a lake steadily rising in response to the rise in Nile Valley deposits estimated at about $4\frac{1}{2}$ feet in 1000 years. Acceptance of that theory now involved belief in a progressive submergence of the newly discovered Faiyum prehistoric sites, from about 14,000 B.C. onwards, until they re-emerged nearly 14,000 years later from beneath more than 25 feet of water, when Moeris was deliberately dried up in early Ptolemaic times (Folding plate: graph). The relation of the Neolithic sites to lake-levels at 222 feet, 180 feet, and 140 feet may be studied on Figures 7 and 8.

(*b*) *Middle Palæolithic Age of Pleistocene Lake.*—The following season archæological investigations were resumed in collaboration therefore with rigid geological inquiry. It was established that the hillocks of sand-rock among and under cover of which the Neolithic people sheltered in settlements at 190–195 feet A.L., consisted of the deposits of the 222-feet lake (Pl. 4, No. 10). They are, in fact, nothing more than the isolated and eroded remnants of the same deposits which form a continuous series in the more sheltered areas (Pl. 2, No. 4). Here then was unanswerable archæological evidence, supported independently by a wealth of purely geological proof (see p. 33) that the 222-feet lake deposits, hitherto believed by all scientific inquirers to represent historic Moeris, had not only largely disappeared, but that sufficient time had elapsed for their consolidation, desiccation, and erosion to approximately their present form *before* the advent of the Neolithic people. Incidentally it shows that the amount of weathering since Neolithic times has been relatively small. Further, had a post-Neolithic rise of lake-level submerged the settlements, signs of it could hardly escape observation in the thirteen weeks spent in the dissection of the largest of them—a midden mound 600 by 400 feet in size, and some 5 feet deep, based on eroded lake deposits of the old 222-feet stage, lying between 208 to 215 feet A.L.

In 1926 we first drew attention not only to the existence of previously unsuspected lake levels at 260 feet A.L., but their association with great numbers of Mousterian (Middle Palæolithic) flakes*; these deposits have now been traced up to 278 feet A.L., at which height they appear to represent the maximum of lacustrine levels in the Faiyum basin (Figure 7*a*). Though littered in profusion *on* these deposits, with some presumptive evidence of their synchronism, we have never, in spite of diligent search, found them *in situ* in conditions acceptable to the strictest scientific control. The 222-feet level (Figure 7*b*) appears to be but a lengthy halt in the retrogressive movement of this extensive Pleistocene sheet of water before it fell at least to 130 feet A.L. or even lower. In the graph (Folding plate) we have endeavoured to combine the sequence of local geological and archæological events, observed in the Faiyum basin in relation to each other. Oscillations of lake-level, and their synchronism at certain points, with various human cultures are founded on positive facts susceptible of proof; but the chronological back-

*"Recent Geology and Neolithic Industry of the Northern Fayum Desert," *Journal Royal Anthropological Institute*, Vol. lvi, pp. 313–14.

ground is of course purely tentative for dates prior to the 4th Dynasty, and has been controlled primarily by local geological considerations, such as the amount of deposition, erosion, etc. Those among us who mistrust the value of an absolute time-scale applied to prehistory will mentally substitute a relative scale. Others will observe with interest that this graph, independent and provincial as it is, fits without serious strain into the general framework of European and North African prehistory.

Figure 7

The letters indicate Neolithic sites examined by the authors

Beginning with our oldest deposit, the 278-feet level of Middle Palæolithic age, we feel compelled, on account of the geological evidence given on pp. 32–3, to allow for a long stationary period at 222 feet A.L. Whilst no direct archæological evidence for the age of this was forthcoming, the fact that a Mousterian industry is found continuing down to the 130-feet A.L. level of this shrinkage period (Folding plate: graph) indicates an extension here of the latest phases of Middle Palæolithic times to about B.C. 13,000—an

extension to which few modern prehistorians will object. The lengthy period of sub-aerial exposure, when all connection with the Nile appears to have been interrupted, during which the 222 feet A.L. and higher beaches were subjected to desiccation and erosion, might therefore correspond to the Achen oscillations in Europe, culturally associated there with the Aurignacean (Early Upper Palæolithic) period, and in North Africa with an ill-defined Mousterio-Caspian phase. For the habitation of the Faiyum at this time we

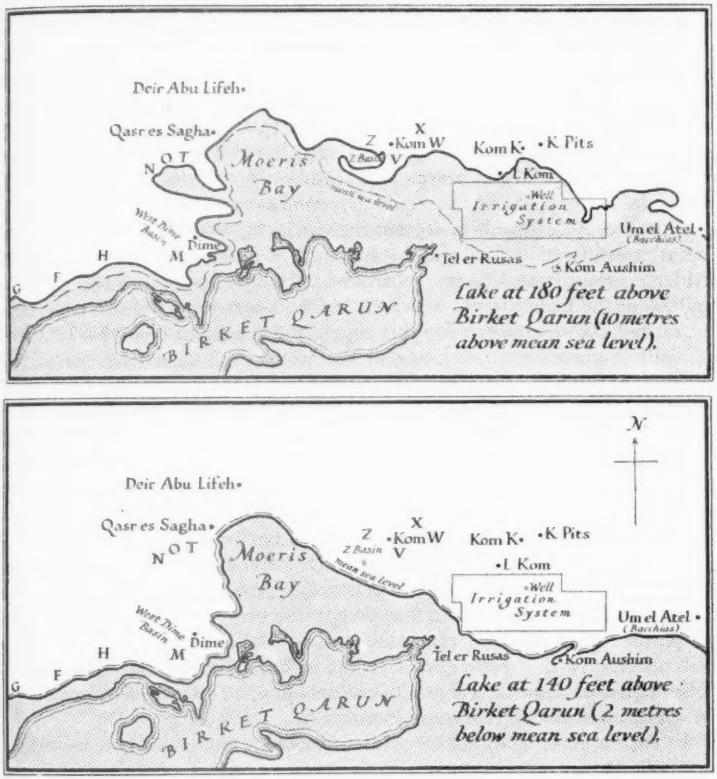


Figure 8. *Note: the scale is approximately that of the general map, p.* 32

can offer no evidence; nor can we do so for the succeeding period, culminating in the 206-feet stage. The faunal evidence indicates that this rise was primarily due to re-establishment of Nile connection; but we are not prepared on the Faiyum evidence alone to commit ourselves as to the climatic factors also operating.

(*c*) *The Neolithic Lake, 206–140 feet A.L.*—All that can be said, with reasonable certainty, is that the arrival in the Faiyum of a pastoral-agricultural tribe, or tribes, possessed of a fully evolved Neolithic culture, developed else-

where, did not happen until after the maximum of the 206-feet Neolithic lake had been passed. We find their settlements strung out along some 40 miles of desert, consistently at 190–195 feet A.L., or 12 to 17 feet below that lake's maximum. Round about 180 feet A.L. may therefore be taken with fair certainty as the water-level by which, on their arrival, they settled (Fig. 8*a*).

We venture to suggest between 6000–5000 B.C. as the date of that arrival—an estimate based primarily upon comparative study of material culture relative to the well-established pre-dynastic sequence in the Nile Valley. That sequence, as is well known, consists of four clearly defined stages prior to the 1st historic Egyptian dynasty *circa* 3500 B.C. The earliest of these, the Badarian of Upper Egypt, though considerably more advanced in certain technical details, has affinities with the earlier stages of the Faiyum Neolithic, which can, to our mind, be best explained by a common origin for both groups.* Now it is certain that the Neolithic Faiyum lake was not a static but a falling one. Minor arrests in its descent (a beach at 160 feet A.L. is shown in the graph) need not detain us, for all stages of level between 180 feet and 145 feet A.L. are culturally associated with the Neolithic industry; typological considerations, in conjunction with levels treated as stratigraphical evidence, necessitate, however, a division of that industry into two phases—an "A" of the higher levels, and a "B" of the lower.† This distinction, however, need not be elaborated in this paper. But the fall of Neolithic lake-level is really important; for, omitting at the moment all considerations of Nile inflow into the Faiyum basin at this period, a falling lake indicates decreasing precipitation and may reasonably be regarded, we submit, as a local repercussion of a far-reaching event transforming North Africa, and the Near East generally, at about this time. This event is the gradual climatic change at the close of the European Bühl stages of the glaciologists, equated, archæologically in parts of Western Europe with Late Magdalenian (Late Upper Palæolithic) times, and in North Africa with a Final Caspian culture. Archæological evidence for widespread prehistoric habitation of the now waterless wastes of the Syrian, Arabian, Libyan, and Saharan deserts is too well known to need elaboration here. We may accept it as proved. It indicates a physiographical régime of open grassy steppe-land, following gradually upon the still moister North African climate, which in Europe is translated into the final Würm glaciation, and in Faiyum by the maximum of lacustrine extension, and its established Mousterian associations.

In such a grass-land, between 9000–6000 B.C., may be sought, we believe, the still obscure origins of Neolithic arts—the development of pastoral semi-nomadic people. The arrival of such people in the Faiyum, which we have already suggested happened some centuries earlier than 5000 B.C., may be supposed to be the result of increasing stringency of pasturage and hunting, attendant both on diminishing rainfall over the open plains, and increasing requirements in a scale of living rendered more complex by the comparatively recent discovery of agriculture. In the Faiyum Neolithic granaries, of which

*'The Badarian Civilization,' by G. Brunton and G. Caton-Thompson (Quaritch, 1928).

†*Man*, July 1928, p. 111; and Catalogue of Royal Anthropological Institute Fayum Exhibition, July 1928, pp. 5, 6.

we found 117, we appear to have the earliest evidence for corn growing yet known, though from what quarter they originally obtained their knowledge and the seed-grain of wheat and barley remains obscure. We may see, in the arrival of the related, but more advanced, Badarians in the Nile Valley, probably some centuries afterwards, a kindred response to the same progressively operative cause.

The archæological evidence for a fall of water-level from 180 to 145 feet A.L. within the span of Neolithic civilization in the Faiyum, is based upon the distribution of flint implements. We have noted that the main settlements of Faiyum "A" period are uniformly at 190–195 feet A.L., and indicate a lake at about 180 feet A.L. But considerable quantities of implements lie also on the surface at lower levels (Faiyum "B" period) and are of types either absent from the midden-mound deposits, or else occur near or upon the surface of them; conversely, the most typical implements in the midden deposits, polished celts, concave base arrow-heads and sickle flints, are practically absent from the lower surface levels. As an industry will not be scattered below the lake-level of its time, but may be found at any height above it, it is normal to find an admixture of both types "A" and "B" on the surface sites of higher, older levels. Significant only is the lowest level at which the older "A" types (constituting closed groups in the middens) are to be found. This we find to be, with very scarce exceptions, 160 feet A.L. The ratio of "A" to "B" types has, even at this level, shifted strongly in favour of "B." This 160-feet A.L. level is marked by a relatively unimportant shore line, indicating a pause in the fall, and giving cause for a concentration of implements. The recession of the lake is, however, subsequently resumed, until 140 feet A.L. is reached. Here a pause of long duration has given rise to a splendid, well-developed beach at least 20 feet in height (see p. 34, Pl. 2, Nos. 5, 6). Upon this, and in its sheltered creeks, we have found a few poor Neolithic settlements, the culture from them suggesting a complete transformation from the prosperous agricultural one of earlier times, to a reduced fishing population using numbers of microlithic flints, together with roughly made survivals of the older, more finely finished types. How long this lingering Neolithic phase survived we have no direct clue; strong inferential evidence would, however, point to its extinction *not later than* about 4500 B.C. This evidence is provided by our discovery, in the midst of a Faiyum Neolithic area, of a settlement midden of alien prehistoric folk, Nile Valley dwellers, whose distinctive flints and pottery belong to the early Middle Predynastic phase in the Nile Valley, and are totally unlike those of the Neolithic Faiyumis. The midden showed no trace of contact with the local Neolithic culture, which would almost certainly have been the case had they been synchronous, and it is in our opinion safe to infer its later date. 4200 B.C. is the latest date we think permissible for this settlement. The graph (Folding plate) allows a margin of 300 years after the final disappearance of the local Neolithic "B."

The evidence of prehistoric archæology as affecting the question of historic Moeris may therefore be summarized:

Palæolithic Times.—(1) Lake deposits unknown to our forerunners have been found as high as 278 feet A.L. Judging by the associated implements, these are of Middle Palæolithic age.

(2) A lengthy pause at 222 feet A.L. in the fall of this sheet of water is marked in the northern desert by thick deposits, showing interesting and very ancient erosional features. In the southern (cultivated) area the same event has given rise to the 222-feet plateau and the 'Idwa "Bank," mistaken by previous inquirers for an artificial embankment bounding historic Moeris. This level is also Palæolithic.

(3) It is followed by a long stage of desiccation and erosion (see (2) above) when contact with the Nile must have been suspended. We have got no archæological evidence for this period, but it may be assumed to straddle across Upper Palæolithic times, evidence for which is singularly lacking throughout Egypt.

Neolithic Times.—(4) Prior to the arrival of Neolithic people in the Faiyum a second lake came into being, attaining a maximum of 206 feet A.L. only. Geological evidence precludes a long station at this level: a gradual fall of nearly 30 feet ensued, followed by a pause at 180 feet A.L. The arrival of large numbers of Neolithic people took place at some time during this pause. They settled in communities near the water's brink, choosing sites under shelter of hillocks formed of surviving remnants of the Palæolithic lake deposits. Fourteen of their settlements have been identified: midden mounds yielding pottery and implements have been excavated; these showed no signs of submergence by historic Moeris. Granaries of the same period have also been excavated.

(5) Stable conditions cease; the lake again contracts by over 30 feet. The Neolithic people follow it, scattering flints down to water-level. A circular and symmetrical chipping floor, showing no water rearrangement of the flint cores, flakes and implements upon it, has been found at 180 feet A.L.

(6) A prolonged pause at 140 feet A.L. is marked by formation of a salient beach, traced for many miles. Poor Neolithic settlements are found upon this beach; the flint-making technique has become decadent; the quantities are limited, compared with higher levels, and the Neolithic culture appears to have died out completely shortly afterwards. We suggest this was about 4500 B.C. at latest.

(7) This beach at 140 feet A.L. could not, in our opinion, preserve its cleanly-cut profile had it been, at any subsequent time, submerged.

The Archæological Evidence. ii. *Historic*

Having summarized the prehistoric evidence, and endeavoured to show how consistently geological and archæological facts militate against the idea of a historic reservoir having existed up to a level of 222 feet A.L., we must now bring forward such historic data as we have collected.

(*a*) *The Old Kingdom, circa* 2980–2475 *B.C.*—This period, covering the 3rd–6th Dynasties, we have found to be well represented in the Northern Faiyum, contrary to the opinion formed by previous investigators, who comment upon the absence of remains in the province attributable to the Old Kingdom.* The sites we have identified as early Old Kingdom include large gypsum quarries lying in the northern scarp with an associated village of hut

*B. P. Grenfell, A. S. Hunt, D. G. Hogarth, 'Some Fayum Towns and their Papyri,' 1900, p. 4.

circles, and two settlement mounds of some size, one east of Umm-el-Atl and another to be described. But apart from these, it was apparent from the first that flint implements of dynastic age lay on the surface mixed with Neolithic types, and around the temple of Qasr-es-Sagha crescent-grinders and hand-picks, typical of the early dynasties, abounded. Further, many dynastic flints were noted at low levels, and provided a key, once the lock were fitted, for investigations on early historic lake-levels. It was desirable therefore to fix more exactly their historic period; and to effect this their discovery *in situ*, with well-dated pottery, was now requisite. A small Old Kingdom settlement at "L" in the northern desert provided that which we sought. Big, coarsely flaked knives with notched handles, and several other types unknown in the Neolithic middens were found in the mound, with quantities of 4th Dynasty pottery, circa 2900–2750 B.C. The key was in our hands, and thereafter the levelling of 4th Dynasty surface flints became an absorbing pastime, and led finally to the discovery of large associated groups of similar flints, and unmistakable 4th Dynasty sherds, upon the great beach-line at 140 feet A.L. already described in relation to final Neolithic times.

This discovery of early historic objects which can be closely dated was of extreme importance, for hitherto one of the most telling and unanswerable arguments advanced in support of a high-level Moeris has always been the supposed absence of dynastic relics beneath the water-level ascribed to that reservoir. It invalidates at a stroke Hanbury Brown's hypothetical continuity of lake-level at 222 feet A.L. from the earliest times; and provides an acid test of the correctness of Sir Flinders Petrie's geochronological scheme, whereby a rise of Nile level estimated at $4\frac{1}{2}$ feet a thousand years would dictate a corresponding rise of lake-level in the Faiyum. For according to this method the 4th Dynasty level should be at 200 feet A.L. reckoned on Sir Flinders' own date of about 4600 B.C. for that dynasty, or at 208 feet A.L. reckoned on the short chronology which we follow—in either case 60 or 68 feet higher than the level of 140 feet A.L.—at which cold fact now proves it really to have been.

(*b*) *The Middle Kingdom*, 2160–1788 *B.C.*—The 11th and 12th Dynasties include the period traditionally so linked up with the origin of Moeris as a controlled reservoir.

Some doubt seems to exist amongst Egyptologists whether the capital, Crocodilopolis (Shedet), whose town mounds are still visible on the north-western outskirts of Madinet-el-Faiyum, was founded during the 12th Dynasty; if it was so, it must have been under direction of the first king of this dynasty, Amenemhat I, for a statue-group of the king has been found there. But there are reasons for thinking it more likely that a town existed on the same site in Old Kingdom times, though this belief would not find acceptance amongst those who believe the whole plateau to have been awash prior to the Middle Kingdom reclamation (Folding plate: general map). That kings of the 12th Dynasty were interested in the province is undeniable. Senusret I has left an obelisk at Abgig on the southern 222-feet plateau, and the pyramid of Senusret II stands at Lahun. Amenemhat III is, however, probably the king called Moeris by Herodotus, whose works are, for our purpose, of far greater importance. These include the Hauwarat pyramid, at the entrance to the

province, the adjacent Labyrinth, and the Biyahmu Colossi. The first two of these monuments bring nothing to bear upon our subject: the Biyahmu monument is situated in a relevant position, and invites attention. In reviewing the Biyahmu evidence we shall endeavour to weigh it on its own merits, although, in view of the prehistoric and early dynastic data for lake-levels, we may be permitted perhaps to consider it a post-mortem inquest.

The Biyahmu Colossi.—All that now remains of the two seated colossal effigies in quartzite of Amenemhat III, described by Herodotus in the passage we have quoted (p. 22), are the massive pedestals, about 21 feet high, which stand side by side about 200 feet apart. Remains of a surrounding rectangular girdle-wall are still visible, four courses of dry masonry at the north-eastern angle being in particularly good preservation (Pl. 4, No. 12). Sir Flinders Petrie, on good evidence, estimates the original height of this wall at about 13½ feet; he believes it to have enclosed a paved court, in which, on their pedestals, sat the twin colossi.* The ground-level of the pedestals is between 203–206 feet A.L., and the structure is situated just north of the line of the 'Idwa bank, which at this point is represented merely by discontinuous sandy areas.

Now the opinion of both Sir Hanbury Brown and Sir Flinders Petrie is that these monuments marked a landing-stage on the great reservoir of a port for Crocodilopolis, an opinion strengthened by their belief in the artificial character of the 'Idwa bank as a Moeris embankment. To quote Sir Hanbury Brown: "Now as the artificial bank was formed along contour R.L. 17·50† (under the conditions assumed) and the water of the lake, as will be shown afterwards, never fell below R.L. 19·50,‡ there would at lowest water be 2 metres depth of water up against the bank, and the most convenient point of embarkation and disembarkation for the inhabitants of Crocodilopolis on their way to Memphis would be at Biyahmu, which they would reach by the road running along the top of the artificial bank formed between Crocodilopolis and Biyahmu" (H. Brown, *op. cit.*, 76). In order to meet the obvious objection to this idea—namely, the state of affairs at high water—Sir Hanbury Brown proposes an improbable reconstruction, whereby the area enclosed within the masonry wall surrounding the colossi was levelled up to 222 feet A.L., despite Sir Flinders Petrie's evidence of a limestone pavement, inside the court, at about 206 feet.

Sir Flinders Petrie refers to the matter in these words: "That the water was on the lower and not the upper side of the dyke (*i.e.* 'Idwa bank) as Linant supposed is proved by the levels. For if the areas within the dyke had been covered with water as a reservoir, the Biyahmu structures would have been submerged some 12 feet; whereas there is no trace of deposited mud on any of the upper stones, nor is the building such that it is likely to have been placed in a depth of water" (*op. cit.*, p. 2); and again: "Hence it appears probable that these two colossi were placed as guarding the approach to the province from the lake, like the colossi on either side of the approach to a temple and probably at the projecting corner of the reclaimed district"

*W. M. F. Petrie, 'Hawara, Biahmu and Arsinoe,' p. 54.
†206 feet A.L.
‡212 feet A.L.

13. Stone-faced ridge of lacustrine sand-rock, south-east of Qasr-es-Sagha

14. "Causeway" at Dimai looking south to the Birket Qarun

15. Southern end of "causeway" at Dimai, with steps and flanking structures

Plate 6

16. Pinnacles of harder material filling a wadi in the 222-foot lake beds, north-west end of Birket Qarun: stick marks junction with lake beds

17. Vegetation along a buried Ptolemaic canal, separated from barren desert by the crack

(*op. cit.*, p. 54). Now an analysis of the position is rendered additionally complicated owing to Professor Petrie's adherence to a chronological dynastic reckoning of his own, which lengthens the period between the 1st and 18th dynasties by about 2000 years beyond that allowed by other Egyptologists. We have endeavoured, however, in the graph (Folding plate), to facilitate visualization. It will be seen that on Petrie s time scale of sediment deposit, high Nile would be about 1 foot below the Biyahmu courtyard pavement, lying at 206 feet above lake, when (following Petrie's long chronology) the colossi were erected aout 3400 B.C. On the commonly accepted short chronology (*circa* 1800 B.C.) it would on the other hand have been laid under nearly 7 feet of water, which is ridiculous: either the sediment-scale reckoning is unreliable or the short chronology wrong. In either case, however, a water-level rising to a supposed Ptolemaic maximum of 219 feet A.L. agreed by Hanbury Brown and Petrie, would gradually submerge the structures to the top of the pedestals, and it is therefore surprising to find, in accordance with Professor Petrie's own observation in 1889, that "there is no trace of deposited mud" in the interstices of the masonry, or signs of the banded discoloration usually seen upon stone which has been under water for a lengthy period.

The fierce storms which even now sweep from the north-west over the attenuated lake, whipping the water into angry white-capped waves, in spite of its deep sheltered cradle, leave scant possibility that the great Moeris, lashing in the full fury of its exposed level upon the dry masonry of the girdle wall of the courtyard and the pedestals of the statues, would leave no mark of its activities upon the structure.

Qasr-es-Sagha.—Within our concession in the Northern desert we found relativelv little material of the Middle Kingdom. That which we found is concentrated near the little temple of Qasr-es-Sagha. The date of this building, discovered by Schweinfurth in 1884, has always been a matter of doubt: its style is unique and it bears no inscriptions. A fragment of inscribed basalt was, however, found in 1925 outside the temple, to which, without any doubt, it belongs, and this is of Middle Kingdom style. Personally we favour the view that the temple was built in the Old Kingdom, and remained in use until the Middle Kingdom: its subsequent history is obscure. In any case the temple can hardly be later than the 12th Dynasty, for the settlement mounds around it yield Old and Middle Kingdom sherds in quantities, and a workshop site within a stone's throw of the south façade was littered with the characteristic flint crescent grinders of the Old Kingdom—about eighty were collected from one spot. Shaft tombs in the hillside had already been excavated, by whom there is no record; but we obtained from the old dump-heaps and tomb chambers ample evidence to prove their 11th-early-12th-dynasty date. In addition we located and excavated an untouched cemetery of forty-one graves, lying at 220–223 feet A.L. at the base of the scarp upon which stands the temple, and these in turn proved also to be 11th–12th Dynasty.

The temple stands on a Tertiary platform of limestone and calcareous sandstone, outcropping at a height of 262 feet A.L. just above the beds of the uppermost lacustrine deposits preserved in this area.

foot lake beds, north-west end of Birket Qarun: stick marks junction with lake beds from barren desert by the track

Sir Hanbury Brown, having ascertained the level of this building, and its associated mounds, found happy support for his theory of a high dynastic lake. "The levels for the old town near Schweinfurth's 'Temple' having been found to be from R.L. 23 to 26 (222 to 232 ft. A L.) the theory that Lake Moeris was a little below the level of R.L. 23·00 is favoured by the determination of this level" (Sir R. Hanbury Brown, *op. cit.*, p. 55). Had he appreciated the fact that lake deposits formed the plateau below that on which the temple stands he would doubtless have interpreted their occurrence in this position as proof positive of the soundness of his theory. But he would have been in error, for the whole tenor of our geological and archæological evidence shows that these lake beds are but the sheltered and fragmentary remnants of the Pleistocene lake. The interpretation of the temple's level, once this fact is established, assumes a totally different aspect; and we can but admire the wise aversion shown by its builders to relatively unconsolidated sandy deposits as the foundation for their massive stone structure, when by ascending a few feet higher a platform of hard Tertiary rock offered itself. A reason for the temple's position (as distinct from level) in this isolated and desolate spot on the north side of the lake has never been found: the solution lies in the hands of a competent excavator, prepared to spend some time on this question: possibly it is the mortuary chapel of some great noble whose tomb lies hidden in the dominating cliffs.

Sherds and flints of early dynasties may be found, not only as Hanbury Brown implies in the temple settlements at 232 feet A.L., but at much lower points to the south of them, down to 190 feet A.L., which is the lowest local level in this direction. Flint flakes of the Old Kingdom have been found as low as 160 feet A.L. in the great indented depression to the south-east, named by us "Moeris Bay" (Folding plate: general map). The contours of the floor of this depression are such that lake water would be but a short distance from the temple in Old Kingdom times when, as we have shown, the level was 140 feet A.L. For its height in the Middle Kingdom we can unfortunately offer no evidence; the shore-line at 140 feet A.L., however, and the complete absence of traces of recent deposits at a high level, preclude, to the best of our belief, any possibility of a Moeris *above* that level: how much *below* it may have been is open to question.

Before concluding the evidence for this period at Qasr-es-Sagha, we cannot avoid reference to three structures in rough masonry which have all, or singly, been referred to at various times as "quays," a dignity to which, without the intervention of the Moeris idea, they could we think hardly aspire, for they consist merely of natural, dissected ridges of lacustrine sands of the Pleistocene lake, which have been crudely faced with roughly squared stone blocks, laid dry. Their date is uncertain; an Old Kingdom flint knife was found upon one of them, and this, if really in place, dates them back to the 3rd millenium. A pair of these stone-faced ridges, their axes lying north–south in compliance with the local drainage, guard the approach to Qasr-es-Sagha temple from the south: water channels from the scarp have cut deeply beneath their eastern flank, making ascent from that side difficult. On the eastern ridge the capping stones are built up into a definite wall of about ten remaining courses (Pl. 5, No. 13). Its present summit lies at about 215 feet A.L.; its natural sandy base

is 204 feet A.L. at the southern extremity. The western structure is more ruinous, but resembles its twin in all essential features.

The third of these largely natural embankments is a striking feature on the lower plateau, south-west of the temple (Pl. 4, No. 11). Its form is a reversed L, the limbs measuring 382 and 276 feet respectively. It, too, is formed of Pleistocene lacustrine sand-rock, ridges and stacks of which are such an interesting feature not only in this neighbourhood, but all along the 190–200 feet A.L. contour, wherever shelter has preserved them: from a base-level of about 190–195 feet A.L. it attains an elevation of 219 feet A.L. and its sides rise sharply to a narrow crest. To whatever purpose the mound was adapted, its summit and upper sides have been roughly faced with practically untrimmed mixed slabs of local limestone and sandstone. Those who, believing in a high-level Moeris, have called this also a "quay" may note, when next consulting local levels, that the "quay" would be an island with a lake above 201 feet (Pl. 4, No. 12).

(*c*) *The Ptolemaic Dynasty*, 323–30 *B.C.*—The Faiyum Province is intimately associated with the Greek Dynasty. Rostovtzeff* has pointed out, on the authority of lists compiled by B. P. Grenfell ('Papyri Tebtunis II'), that of the 114 Faiyum towns and villages mentioned in papyri as existing early in the dynasty, 66 have Greek names and only 48 Egyptian.

To an early Ptolemy—probably the second—is generally attributed the conception and execution of reducing, by check of inflow and evaporation, brimming Moeris (believed on the Herodotian evidence to be at this time lapping the 222-feet A.L. plateau, and surrounding the Biyahmu colossi nearly to the top of their 21-feet pedestals), in order to procure more land upon which to settle Macedonian soldier-settlers. Certain it is that Ptolemaic villages, temples, and cemeteries are distributed in numbers at all levels over the province, from the City of the Arsinoites, the capital, previously Crocodilopolis, at 222 feet A.L., to Tell-er-Rusas (the lowest Ptolemaic site we can identify) at about 15 feet A.L.

One of our earliest camping-places was Dimai, the Soknopaios Nesos of classical times, a splendid ruined Græco-Roman temple and town, situated 4 miles south of Qasr-es-Sagha, on a limestone plateau running north-west to south-east, at a height of between 205–210 feet A.L. The accumulated *débris* of the ruins on the summit raises the mounds to a level of about 240 feet A.L. Although concentrating our activities in that early visit almost entirely upon prehistoric and geological research, we nevertheless found it impossible to refrain from mapping and levelling the embankments of an irrigation system, west and north-west of the town, and giving such examination as was feasible without prolonged excavation, to a much-debated structure—"quay" or "causeway" as it has been named by previous observers. This is a paved road heading due south for a distance of 436 yards, in alignment with the main axis of the temenos walls (Pl. 5, No. 14). The limestone pavement is carried upon massive masonry foundations, raising it some feet above the ground-level of the fringing Ptolemaic mud-brick ruins. It terminates abruptly at its southern extremity in a flight of eleven shallow steps, of which eight actually

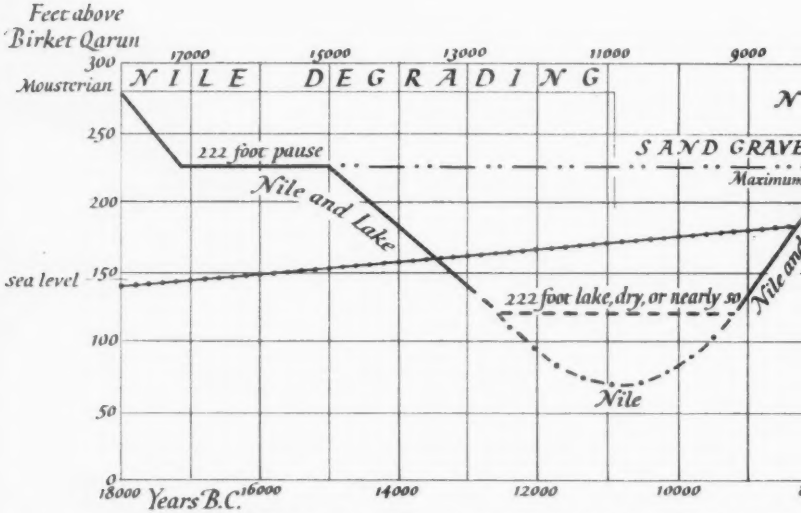
*M. Rostovtzeff, 'A Large Estate in Egypt in the Third Century B.C.,' p. 9 (University of Wisconsin Studies, 1922).

remain, 10 feet wide by about fifteen to eighteen inches deep and three inches high, flanked by two rectangular ruinous wings (Pl. 5, No. 15), all of which were buried deep in drift sand, and had to be dug out. The bottom step, however, does not lead down on to desert level, but hangs in mid-air, as it were, with the vertical wall of its foundations beneath it—a drop of about 6 feet. The face of this wall shows perfectly regular courses and well-dressed masonry; there can be no question of a vanished continuation, and the structure is seen as originally planned by the architect, and finished by the builder. The flanking structures have however clearly been tampered with at a later date. The foundations of this peculiar building are laid on lacustrine gravels at 205–206 feet A.L. containing intrusive Græco-Roman sherds and other alien bodies, thrown down before, or during, the foundation levelling. We have no qualifications for contributing ideas as to the purpose of this long paved way, leading apparently to nothingness. Our mission was to plan it, and examine its possible relation to lake levels, in view of Schweinfurth's, Hanbury Brown's, and Petrie's diagnosis of it as a Moeris quay. We may observe, however, that Grenfell and Hunt were dissatisfied with this interpretation. They say, "The stone causeway that runs through the middle of the town up to the temple on the summit of the slope upon which Dimai stands, has been supposed by Major Brown and others to have been originally a quay. If this were really so, the level of the supposed quay would be an important piece of evidence for the height of Lake Moeris at the time when it was built. But a visit to Dimai last April has made us sceptical about the correctness of this explanation of the causeway. It is absolutely certain that Dimai was not an island in the Græco-Roman period, and that it was well above the lake then is shown by a comparison of the level of the lower end of the causeway, R.L. 22·6 [221 feet]* with the level of Qasr Qarun, R.L. 4 [160 feet]. The ruins, which have for the most part been thoroughly ransacked by native diggers, have not disclosed anything pre-Ptolemaic; and since the causeway is clearly connected with the temple to which it leads, we should prefer, unless traces of an earlier temple can be found beneath the present Ptolemaic one, to suppose that the causeway is of the same date as the ruins of the rest of the town. In that case it is not likely to have had anything to do with a quay."†

Our contribution to this question is the discovery of Græco-Roman sherds from beneath the "quay's" foundations, and a fragment of a late Ptolemaic-early-Roman bowl rim which came from a bed of white plaster beneath the loose stone slab forming step no. 5. This building clearly cannot then be earlier than Ptolemaic times. There appears, however, to be no internal evidence of value as to the precise reign within the Ptolemaic dynasty in which Dimai temple and town were built: but we now hold a piece of presumptive evidence in this connection of quite first-rate importance to the whole question. Postponing for the moment discussion of this, let us examine more closely data for a supposed quay in relation to a supposed high-level Moeris as upheld by the supporters of this view.

*Our own levelling gave the height as 216 feet A.L. The discrepancy is probably due to lack of accurate information 30 years ago as to lake level.

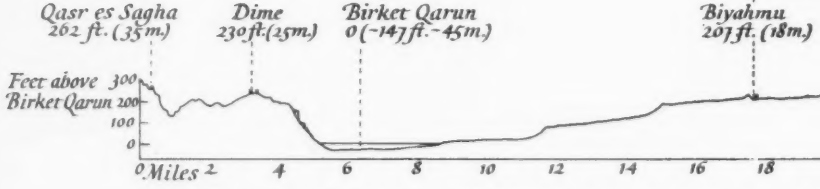
†B. P. Grenfell and A. S. Hunt, *op. cit.*, p. 6.



LAKE LEVELS IN THE FAIYUM FROM MOU

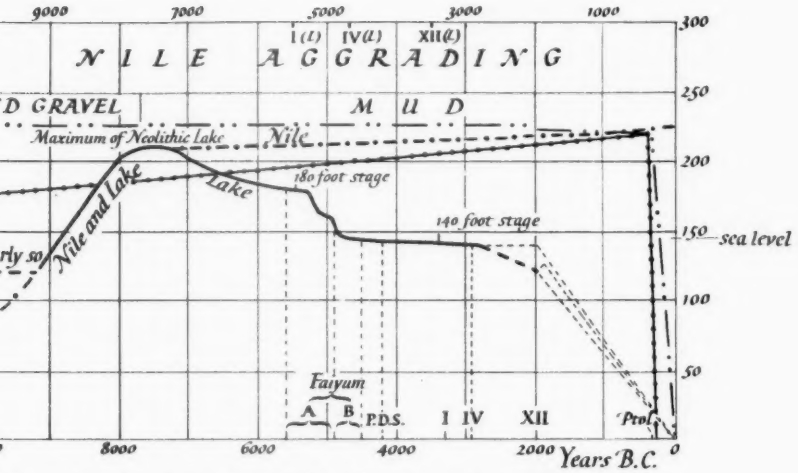
According to Hanbury Brown — ·· Flinders Petrie ····

Dates before 5000 B.C. are hypothetical and introduced only to shew relation t
different lake periods are however approximately correct.



NORTH AND SOUTH PROFILE OF THE FAIYUM

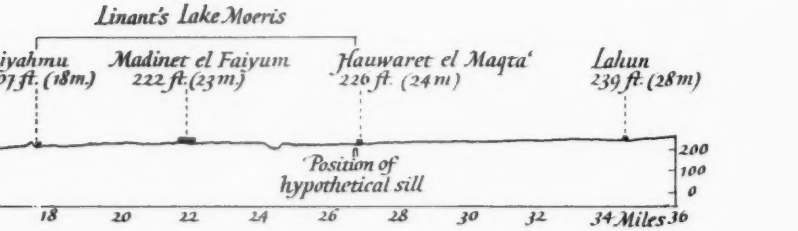
Vertical exaggeration approx



M MOUSTERIAN TO ROMAN TIMES

trie ····· The Authors —— Nile Level -·-·-

y relation to Petrie's time scale of silting. The relative durations of the



AIYUM BASIN FROM QASR ES SAGHA TO LAHUN

ration approximately 30 times

THE FAIYUM DEPRESSION

CATON-THOMPSON AND GARDNER

(*a*) The drying up of Moeris is attributed to an early Ptolemy—I, II, or both,* †, *i.e.* between 323–245 B.C.

(*b*) A quay at 216 feet A.L. is therefore of use only prior to its drying up.

(*c*) Since it is agreed by all that Dimai is Ptolemaic, therefore it follows from (*a*) and (*b*) that it was built some time within the years 323–245 B.C.; that being so a quay could be of service only during that year or two when Moeris, falling by natural evaporation at a rate estimated at a minimum of 3·6 mm. a day from the 222-feet A.L. maximum at which the Ptolemies found it,‡ reached a level of 216–211 feet A.L. Beneath this level our quay is useless as such, and we found the remains of no other. Thus the "quay" with its elaborate 436 yards of stone causeway would have served its purpose for about two and a half years only. Our late Ptolemaic sherd from beneath the step can mean one of two things: (*a*) that it was built in when the steps were originally laid, in which case it dates the structure as late Ptolemaic, and its purpose could not therefore be a quay ; (*b*) it reached its position during repairs to the steps in late Ptolemaic times—in which case one wonders why quay-steps, long since useless and leading nowhere, should be repaired at all.

Discovery of the Irrigation Works of Ptolemy II, 283–245 B.C.—Amongst the quantities of papyri dug up from Græco-Roman settlements in the Faiyum, are frequent allusions to irrigation: from them are actually known the names of certain of the engineers and other officials who, during the reigns of Ptolemy II and III, were engaged in creating more agricultural land. In 1915 an exceptionally rich haul of papyri dating to Ptolemy Philadelphus was made at Philadelphia, and forms the subject-matter for M. Rostovtzeff's delightful study entitled 'A Large Estate in Egypt in the Third Century B.C.' The place-name shows that this site, now entirely desert, was founded under the second Ptolemy, and the earliest document in the recovered archives dates from the twelfth year of his reign, 271 B.C. It continued in use until the fourth century A.D., but, in common with many other Faiyum sites, its prosperity waned some two centuries earlier.

Philadelphia was especially renowned for its vineyards, the fame of which continued into Roman times, but the area given up to this and other rich produce has not been identified. The ruined town mounds, ransacked by papyri-hunters, lie at 230 feet A.L. Traces of a great canal—the Bahr Wardan—148 feet wide from bank to bank at the spot of our trial section by the town mounds, with a channel 135 feet wide and 14 to 15 feet deep, run past the town, and may be followed as far as Umm el Atl (the ancient Bacchias) where all trace disappears.

How then were Kom Aushim (Karanis) and Dimai (Soknopaios Nesos), lying respectively about 6 and 18 miles west of the Bahr Wardan's termination, watered? Careful search for continuation of the canal west of Bacchias has hitherto proved in vain for all who have undertaken it. There has been no answer to the question until December 1927, when, after heavy rains, the sprouting of seedlings upon the buried lines of the old canals (Pl. 6, No. 17)

*Edwyn Bevan, *op. cit.*, p. 115.

†W. M. Flinders Petrie, 'History of Egypt,' vol. 1, p. 202.

‡Sir Flinders Petrie, *Journal of the Royal Anthropological Institute*, vol. 56, 1926, p. 326.

enabled us to locate, level, and work out in detail a network of small and large irrigation channels, covering 21 square miles of now desert land, north-west of Karanis. Owing to encroachment of tongues of recent cultivation over the ground lying between Umm el Atl and our most easterly canal, we were not able actually to trace the connecting link with the Bahr Wardan, but a study of the levels (both ends being now known) makes its course fairly certain.

The 16 miles of canals we levelled and mapped run for the most part along the edges of the inland basins between 167–173 feet A.L. Excavation of a group of Ptolemaic house ruins on the edge of a canal at 185 feet A.L. yielded the required dating. Ten bronze coins of Ptolemy II—Philadelphus—were found in the rooms and courts. These coins can be yet more closely dated, and they are said by the expert who kindly reported on them to belong to issues of the first twenty years of the reign: he remarks that it is improbable that the coins, with the possible exception of two, were in circulation for more than fifteen to twenty years. We thus see that our area of basin irrigation is closely connected with the Philadelphia evidence.*

An important discovery in connection with problematic Moeris levels was a large stone-lined reservoir, with a storage capacity of about 86,000 gallons. This was used to irrigate a large depression upon the edge of which it stands (Figure 8*b*). Typical "gawadys" or water-jars, used for lashing on to a water-wheel, were found at the bottom, providing us with the quite new evidence that this system was in vogue in early Ptolemaic times. It suggests that this particular method of water distribution was introduced into Egypt by the Persians. In any case it long antedates the Roman period, hitherto credited with the introduction of this system. A quantity of vine stems were found in the lower levels of the sand-filling. The rim of the reservoir is at 163 feet and its bottom at 132 feet A.L. Its construction is securely dated to the first half of the reign of Ptolemy II by a coin found at the quarry which supplied the facing stone.

Unfortunately we were unable to trace, in default of much-needed assistance from the R.A.F. Survey, the continuation of the canals over the 15 or so miles (following the probable contours) separating our area from Dimai† (Folding plate). The Dimai irrigation system, the plan of which we made, remains therefore still disconnected and isolated. Its style is different, and we believe it to be decidedly later in date: nor is it likely on general grounds, that a great temple and town were built there, dependent as it must have been for its water on miles of cross-desert canal, until the districts nearer the headwaters, such as Philadelphia and Bacchias, had been safely established, and were in a position of sufficient security and prosperity to afford to pass on their surplus waters along the canals to Dimai. These new disclosures of closely dated early Ptolemaic houses at 185 feet A.L. and the contemporary reservoir at 132 feet A.L. show that Moeris, on purely Ptolemaic evidence, had vanished long before. Dimai can hardly, in view of its remote position, be older than

*The original pronouncement as to the coins' dates, whereby two were attributed to Ptolemy III, is not accepted by Mr. Seltman, upon whose expert opinion we rely.

†One of us (G. C. T.) is convinced of their existence; the other (E. W. G.), in view of level difficulties over the Moeris Bay area, necessitating great raised embankments, no trace of which we could find, remains doubtful, but can offer no alternative.

Philadelphia, and when it was built the lake was somewhere below 132 feet A.L. Those who can still proclaim, despite this weight of geological and archæological evidence, covering many different periods, their belief in a high-level reservoir, lasting from 12th Dynasty to early Ptolemaic times, will be faced at least with the necessity to compress the period required for evaporation of 90 vertical feet of water, and conversion of lake floor into agricultural land, into the forty years of Ptolemy the First's reign, or carry the process back into the Persian period. If that be so, we may perhaps be forgiven for asking why from amongst the great numbers of Faiyum Græco-Roman sites which are known, no coins or papyri earlier than Ptolemy Philadelphus appear to have been recorded?

7. *A New Interpretation*

(*a*) *Synthetical Suggestions*.—The archæological and geological data we have collected and upon which we base our belief that the accepted view of Moeris requires drastic revision may therefore be finally tabulated:

(1) The 222-feet A.L. deposits belong to the oldest lacustrine series in the basin, not to the latest. They are Middle Palæolithic in age. No later deposits with recent fauna have been found in any place overlying them, at levels above 206 ft.

(2) The 'Idwa bank is shown by its bedding and fauna to be a natural beach (of Pleistocene age as (1) above), not an artificial embankment of the 12th Dynasty.

(3) Neolithic settlements lie *upon* deposits of the oldest series (1), at 190–195 feet A.L. They show no signs of submergence. They are connected with a second lake with different fauna from (1), never exceeding 206 feet A.L. No later deposits with recent fauna have been found in any place overlying them.

(4) Later Neolithic settlements lie upon a great beach at 140 feet A.L. This beach is sharply defined, and no later deposits with recent fauna have been found in any place overlying it.

(5) Settlements of the 4th Dynasty lie also upon this beach. A fixed dynastic lake-level is thus provided for the first time, and it is far below the point postulated by all other inquirers.

(6) At levels below 152 feet A.L. tamarisk stems and reeds are unfossilized, and the fauna is fresh in appearance. At higher levels calcification of both reeds and stems has taken place, and in no instance has a fauna of fresh and recent appearance been found, as would be expected had the lake retreated from the 222-feet A.L. level only 2000 years ago.

(7) The Middle Kingdom settlements at Qasr-es-Sagha would not be cut off from the lake water supply, as had been supposed, with a lake at 140 feet A.L. or somewhat below. The contours show a great depression below sea-level swinging up close to it.

(8) An irrigation system, between 173–132 feet A.L., has been discovered, dating to the earlier half of Ptolemy the Second's reign. It is inherently improbable (apart from the foregoing evidence) that the irrigated area was newly emerged lake bottom.

We can say definitely that within the course of prolonged and detailed field work over an area embracing the northern, western, eastern, and parts

of the southern Faiyum, we have, in spite of continued vigilance, found absolutely nothing of positive value to counterbalance against these eight established facts. Wherever we have been able to check the points adduced in support of a Herodotian reservoir—the 'Idwa bank, the Bats drain, the position of dated monuments, high-level lacustrine deposits—we have found the observations upon which they rested to be either incomplete or definitely and demonstrably incorrect.

We will now attempt to correlate our view of a low-level historic lake with all the available data, and consider the position in the Faiyum as we believe it to be, in relation to the Nile Valley.

The Middle Palæolithic in the Nile Valley is found at a level of 25–30 feet above river-level, succeeding a series of higher terraces containing Lower Palæolithic implements. Neither these higher terraces nor their implements have been identified in the northern desert of the Faiyum; but the Middle Palæolithic terrace-level of the Nile Valley agrees closely with that of our highest lake beds at 278 feet A.L., and it is obvious that the two were already at that remote period in communication *via* the Hauwarat channel.

It is generally agreed that the floor of the Nile Valley lies far below the present surface, and the degrading of the river which was operative throughout Lower and Middle Palæolithic times did not cease at this moment (Folding plate: graph). As Prof. Petrie was the first to point out, hidden stages of continued degradation in the Nile Valley are represented in the Faiyum, and are seen in the falling levels of the 278-feet lake, with its accompanying 222-feet pause. The evidence of the desiccation of this lake, so marked in the Faiyum, at about sea-level, probably indicates that the Nile had degraded its bed below the point at which communication with the Faiyum was any longer possible.

It has been seen (p. 37) that our evidence in the Faiyum points to the Mousterian culture lasting on into that period of degradation which in the Nile Valley is now hidden by alluvium. This can be fitted quite reasonably into the recently published summary by Messrs. Sandford and Arkell, of events in Upper Egypt, where the Palæolithic succession "is continued by silts laid on the gravels containing Mousterian implements (period of aggradation) with a succession of Sebilian* (local Capsian) industries."†

In Middle Egypt, however, we detect what appears to be a singular discrepancy in sequence, since here the terrace slightly below the Mousterian in the Nile Valley and our 222-feet A.L. lake pause, are both attributed by these investigators to Sebilian times. Now the Mousterian terrace has been followed into the Faiyum, and is clearly contemporaneous with our highest-level lake of the same age; but all our Faiyum evidence points to the 222-feet A.L. stage being but a pause in the fall of this lake. Therefore it seems necessary to assume that lower terraces in the Nile Valley were formed when the Nile was still cutting downwards, as seems agreed by Messrs. Sandford and Arkell. Yet in *Middle* Egypt this stage is given by them as Sebilian,‡

*Sebilian is the name used to designate flint industries found by Monsieur Vignard near Kom Ombo, believed to be of Upper Palæolithic age.

†K. S. Sandford and W. J. Arkell, "Terraces of the Nile in Upper Egypt" (abstract), Report of the Commission on Pliocene and Pleistocene Terraces. International Geographical Union, 1928, p. 17.

‡K. S. Sandford and W. J. Arkell, *Nature*, 28 April 1928, p. 670.

whilst the period of aggradation is relegated to post-Sebilian times: further, the higher terrace is given as Lower Sebilian, and the lower as Upper Sebilian, which increases the difficulty of accounting for these levels in Middle Egypt as due to aggradation.

A river may be eroding in one part of its course and depositing in another; but normally deposition proceeds from the mouth upwards: it seems therefore unlikely that the Nile could have continued to cut its bed to some great but unknown depth in *Middle* Egypt after Mousterian times, as the Faiyum evidence indicates, while in *Upper* Egypt aggradation immediately succeeded that period. Until more facts are published by the Oriental Institute of Chicago's Prehistoric Survey it seems difficult to reconcile this discrepancy, and we must, therefore, hold to our own sequence of events. In either case the date of the 222-feet lake is Palæolithic, and long prior to historic times.

The problem of the correlation of the heights of sea and river-levels during the Middle Palæolithic period in Egypt has, so far as we know, not been yet attempted, and the existing information is insufficient to afford a secure basis. But since it is a question that must arise in the minds of workers in other areas, we would suggest that if the higher of Messrs. Sandford and Arkell's Mousterian terraces in Upper Egypt* (30 feet above river level) be joined to their Middle Palæolithic terrace in Middle Egypt (at 25 feet above river level), say at Beni Suef, a gradient is obtained which if continued northward would reach a height of 66 feet above sea-level in 112 miles.

Now due north at Alexandria there are no raised beaches to assist in determining ancient sea-levels:† but at the head of the Gulf of Suez there is a well-defined series at 700, 200, 98, and 66 feet above sea-level.‡ This region lies 106 miles north-east of Beni Suef; and it would therefore seem reasonable, in view of the gradient given above for the Middle Palæolithic terrace, to correlate this terrace with the 66-feet beach level.

This conclusion is rendered additionally probable by the fact that the 66-feet, or Monastirian beach, though found locally at varying heights, is indirectly associated in other parts of the Mediterranean region (Gibraltar, Devil's Tower; Mentone, Grotte du Prince and Barma Grande; and just possibly Malta, Ghar Dalam cave) with late Mousterian Middle Palæolithic implements.

After base-level at some great, but still unplumbed, depth had been reached in the Nile Valley, aggradation followed. This process in the course of time enabled free communication with the Faiyum to be resumed. To this we attribute the rise of the 206-feet A.L. lake. Borings in the Nile Valley in Middle Egypt (*i.e.* a point near the Faiyum) show that relatively coarse sands and gravels lie 30–35 feet below the surface only.§ This suggests that the aggrading stream was running with considerable velocity and would, therefore, be capable of keeping clear the Faiyum inlet channel. When, however,

*Page 17.

†W. F. Hume and O. H. Little, "Raised Beaches and Terraces of Egypt," Report of the Commission on Pliocene and Pleistocene Terraces. International Geographical Union, 1928, p. 10.

‡Page 12.

§Sir Wm. Willcock's 'Egyptian Irrigation,' vol. 1, p. 94, fig. 3. 1913.

in normal course these conditions changed, and a more sluggish stream deposited great quantities of mud, these two factors together would rapidly cause complete stoppage of the connecting channel already considerably choked in all probability by the coarser material, and now substantially aided by the rapid growth of reedy vegetation in the silty channel.

Modern irrigation canals show that silting takes place with much greater rapidity when the angle of take-off of a branch is 45° and over.* It will be seen on the map that the Faiyum inlet takes off from the Nile Valley at an angle of nearly 90°. This then must have greatly facilitated the silting process. Further, we conclude from the results of Willcocks that mud deposition in the Nile Valley began at about 18 m. (206 feet A.L.), which emphasizes in no uncertain fashion the correctness of our local Faiyum deductions of the factors controlling the 206-feet lake (Sir W. Willcocks, 'Egyptian Irrigation,' vol. 1).

As soon as communication was interrupted climatic conditions became the dominant partner in the determination of lake levels, and the subsequent history of the Neolithic lake may be summarized as one of progressive desiccation, arrested temporarily at the 180-feet and 140-feet A.L. levels.

We can interpret these pauses best as indicating that at these periods the rainfall compensated, and was not subservient to, evaporation. Reference to our graph (Folding plate) shows that we have allowed not less than 1700 years for the formation of the beach deposits at 140 feet A.L. This estimate is based both on the local geomorphic evidence, and upon the occurrence of lingering late Neolithic settlements upon this shore-line, which was also occupied again long afterwards by dynastic fisher-folk of the 4th Dynasty. As this interpretation postulates a rainfall cycle in predynastic, extending to early dynastic, times, it will be well to seek guidance for this from other available sources. We have not far to travel: upon the famous mace-head of King Na-Mer, or Menes, first king of the 1st Dynasty (*circa* 3500 B.C.), now in the Ashmolean, is carved a scene showing the King assuming the Red Crown of Sais, capital of the Delta Kingdom, conquered by him. To quote Professor Newberry: "The inscription accompanying it records that he had captured 120,000 prisoners, 400,000 oxen, and 1,422,000 goats. This immense number of oxen and goats is clear evidence that the north-western Delta and the region to the west of it (Tehenu-land) must have included within its boundaries very extensive grass-lands. Several centuries after Menes, Sahure, a king of the 5th Dynasty, captured in Tehenu-land 123,440 oxen, 233,400 asses, 232,413 goats and 243,688 sheep. Senusret I also captured in the same region 'cattle of all kinds without number.' This again shows how fertile the country must have been at the beginning of the Middle Kingdom."†

Pasturage for herds of this magnitude in the Western Delta region, much of it now desert, in the 1st and 5th Dynasties presupposes considerable rainfall, and harmonizes with our observations of a static shore-line throughout pre-dynastic times, continuing up to, and including, the period of the 4th Dynasty, whose settlements we have found upon it.

*Sir W. Willcocks, *op. cit.*, vol. 1, p. 321.

†P. E. Newberry, "Egypt as a Field for Anthropological Research," Presidential Address to Section H. British Association, 1923.

Throughout this long period the condition of the southern 222-feet A.L. plateau would be that of a swampy mud flat. In Old-Kingdom times a settlement appears to have been established, probably near Madinet-el-Faiyum, for the name "Shedet" appears in the Pyramid texts (5th Dynasty), meaning, it is said, the "rescued" or "extracted." We may imagine the village as a clearance in the reedy plateau, drained by a system of dykes and ditches. It is possible that an embankment, north of the temple area, may be the remains of this work,* and flint knives of the Old Kingdom have actually been found within this area.

(*b*) *Suggested Nature of the Middle Kingdom Waterworks.*—What then of the story, so constantly repeated in classical antiquity (the dynastic Egyptians themselves are strangely dumb about it), of the artificial conversion of the Faiyum, by monarchs of the 12th Dynasty, into a reservoir capable of storing and returning surplus flood waters of the Nile? The tradition cannot be brushed aside, and some reasonable explanation should be possible. We suggest that the great work in the 12th Dynasty consisted in the artificial re-cutting of the Hawara channel, silted up since Neolithic times, in order to irrigate the 222-feet A.L. plateau, and in the conversion of that waste and swampy marshland by controlled drainage into a rich and prosperous province. To effect this some form of water barrage at the entrance would be necessary. It is possible that some of the water was returned to the Nile Valley to supplement any deficiency in the flood level, thus giving rise to the later story of a lake reservoir. These works would be an achievement of no mean order, sufficiently stirring in magnitude and economic value to give rise to a fabulous tradition.

According to the idea of those who, on the authority of Herodotus, profess belief in a high-level reservoir, all except some 27,000 acres, or 42 square miles, of this rich land lying around Crocodilopolis would be permanently submerged, and lost to agriculture, in order temporarily to benefit the Nile Valley at time of low Nile.

According to our idea of a dynastic lake-level never exceeding 140 feet A.L., no less than 153,600 acres, or 240 square miles, would be available for agriculture—no mean consideration in a country where every available acre capable of irrigation is pressed into service.

A point which we do not think has been noticed before, but which seems to us significant, is the mention both in Herodotus' account of the origin of Lake Moeris, in later classical references, and also in that of an Arab chronicler, of vast digging operations. Herodotus says, referring to the lake, "the deepest part has a depth of fifty fathoms. *That it has been dug out and made by men's hands the lake shows for itself. . . .*" And again, "*I could not anywhere see the earth taken from the digging of this lake, and this giving me matter for thought, I asked those who dwelt nearest to the lake where the stuff was that had been dug out.* They told me whither it had been carried, and I readily believed them, for I had heard of a like thing happening in the Assyrian city of Ninus. Sardanapellus, King of Ninus, had great wealth, which he kept in an underground treasury. Certain thieves were minded to carry it off; they reckoned their course and dug an underground way from their own house to the

*W. M. F. Petrie, 'Hawara Biahmu and Arsinoe,' p. 2.

palace, carrying the earth taken out of the dug passage at night to the Tigris, which runs past Ninus, till at length they accomplished their desire. *This I was told, had happened when the Egyptian lake was dug, save only that the work went on not by night but by day. The Egyptians bore the earth dug out by them to the Nile, to be caught and scattered (as was to be thought) by the river. Thus is this lake said to have been dug*" (Herodotus, Bk. II). The idea of the lake being dug out has been unanimously considered preposterous. Yet just in this part of Herodotus' narrative, which seems most fantastic and has, whatever may be the historical merits of the rest of the story, been condemned as nonsense, we discern a glimmer of what we believe may be the truth shining through the superposed errors. These great excavations, attributed by the local tradition of seventeen centuries later to the creation of the lake itself, may, we suggest, be reasonably transferred to the excavation of the silt-choked Hauwaret channel. We may venture, very tentatively, yet further and suggest that the earth thus excavated was, perhaps, indeed borne away on barges and disposed of in the Nile Valley. The persistence with which the tradition of great excavations in connection with Moeris lingered on is exemplified in similar references by Diodorus Siculus (*circa* B.C. 20) and Pliny (*circa* A.D. 50–70). Diodorus says (Bk. II, chap. 1) that King Moeris "caused a lake to be made, wonderfully commodious and of incredible bigness. He caused a trench to be dug from the river Nilus to the said lake," etc. And Pliny (Nat. Hist. Bk. XXXVI, chap. 16), discussing the pyramids, says there are "two in the place where Moeris was excavated."

Turning now to an Arab tradition, which is embodied in an article by Mr. Cope Whitehouse in the *Contemporary Review* 1887, we find reiterated allusions to great excavations. Joseph, so runs the tale, serving at the court of Pharaoh, was, on account of his great power with the monarch, the object of envy to his enemies at court. They persuaded the King to set him a task to serve as a test of his capacity. At that time the Faiyum was a marsh, called El Hun, serving as a waste basin for the waters of the Nile which flowed in and out without hindrance. "The courtiers having taken counsel together what to propose to the King, gave this reply to Pharaoh: 'Lay the royal commands upon Joseph that he shall divert the water of the Nile from El Hun and drain it, so as to give you a new province and an additional source of revenue.' The King assented, and summoning Joseph to his presence, said, 'You know how dearly I love my daughter, and you see that the time has arrived in which I ought to carve out an estate for her out of the crown lands. I have, however, no territory available for this purpose except the submerged land of El Hun. . .' " Joseph undertakes the work. "Then Allah inspired Joseph with a plan. He directed him to make three canals; one from Upper Egypt, a canal on the east, and a canal on the west. Joseph collected workmen and dug the canal of Menhi from Ashmunin to el-Lahun. Then he excavated the canal of El Faiyum, and the Eastern canal, with another canal near it called Ben-Hamed to the west. In this way the water was drained from El Hun; then he set an army of labourers at work. They cut down the tamarisks and bushes which grew there and carried them away. At the season when the Nile begins to rise the marsh had been converted into good cultivable land. The Nile rose; the water entered the mouth of the Menhi canal and flowed down the

Nile Valley to El Lahun; thence it turned towards El-Faiyum, and entered that canal in such volume that it filled it and converted the land into a region irrigated by the Nile."*

(*c*) *Conclusions*.—Our conclusions are therefore totally opposed to those of Sir Hanbury Brown and others who believe in a 222-feet A.L. lake existing in the Faiyum from prehistoric to Ptolemaic times. They are in agreement with those of Sir Flinders Petrie up to a point: we both attribute the 206-feet lake to the rising waters of the Nile. We differ from him in putting this event a great deal further back in time than he does; we believe it to have taken place *before* the establishment of the older Neolithic settlements (whose date may carry us back well into the 6th millennium), whilst Sir Flinders believes it to be Middle Dynastic (*circa* 3500 B.C. long chronology, 2000 short chronology).

Further, as opposed to all other views, we believe that there never was a high-level historic lake, but that the Neolithic lake fell in stages, giving rise to historic Lake Moeris at 140 feet A.L. or lower, which was of considerable duration.

The year of Herodotus' travels in Egypt is not certain, but 450 B.C., or possibly a year or two later, is agreed to by scholars. His visit is thought to have been a comparatively short one, of not more than three or four months' duration, and it happened in the season of inundation—namely, August to November.† We suggest that what he saw in the Faiyum, possibly from the vantage point of the Hauwaret pyramid, was not a lake filling the entire depression, but the various basins of the whole fertile province flooded with irrigation water, creating the impression, possibly assisted by mirage, of one vast lake. Herodotus himself thus describes the inundation: "When the Nile overflows the land, the towns alone are seen high and dry above the water, very like the islands in the Ægean Sea. These alone stand out, the rest of Egypt being a sheet of water" (Herodotus, Bk. II, 97). Under these conditions the Biyahmu colossi would indeed give him the impression, from a distance, that they stood in the lake, "for almost in the middle of it stand two pyramids so built that 50 fathoms of each are below and 50 above the water. . . ." (Herodotus, Bk. II, 97).

As to sources of his information we cannot do better than quote the authoritative and impartial opinion of Professor W. Spiegelberg.‡ "Herodotus has faithfully recorded, not history, but stories—historical romances and legends, as opposed to chronicles and annals—or whatever name you may like to give to the echo which historical happenings left behind in the soul of the common people. For it was among the populace, if I may include among them the 'priests' and dragomans, as guardians of popular tradition, that Herodotus collected his stories. What mainly survived down to his day of the great deeds of the past?

"1. Legends, the recollection still living on among the populace of the famous deeds of old.

*Quoted by R. Hanbury Brown, *op. cit.*, pp. 22–23.

†Sourdille, 'La durée et l'étendue du voyage d'Hérodote en Egypte' (1910)

‡W. Speigelberg, English translation by A. M. Blackman, 'The Credibility of Herodotus' Account of Egypt in the Light of the Egyptian Monuments' (Oxford, 1927), p. 31.

"2. Monuments, which prompted the popular imagination to invent legends and tell stories.

"These were Herodotus' sources, not inscriptions and papyri."

With this opinion our geological and archæological examination of the problem of Lake Moeris leads us to agree.

Our grateful thanks are due to the President and Council of the Royal Anthropological Institute for standing sponsor to the expedition; to the Hon. Sec. and Fellows of the Institute; to the Trustees of the Stuart Research Fund of Newnham College; to the Percy Sladen Trustees: the Royal Geographical Society; the Geological Society; the Egyptian Ministry of Public Works; Sir Flinders and Lady Petrie; and to many friends for their financial support, without which nothing could have been accomplished.

DISCUSSION

Before the paper the PRESIDENT (Col. Sir CHARLES CLOSE) said: To-night it is our privilege to be about to listen to a lecture by Miss Caton-Thompson and Miss Gardner on the problem of Lake Moeris. These two ladies have spent, I think, three seasons—1924–25, 1925–26, and 1927–28—on the northern part of the Faiyum district investigating this and many other matters connected with it. It was a problem started, I understand, by Herodotus and carried on in a secondary way by Strabo and Pliny. In recent years we have, connected with it, the names of Sir Flinders Petrie and the late Major Sir Hanbury Brown. Sir Hanbury Brown said that to tackle this problem successfully one must be a palaeontologist, an archaeologist, an Egyptologist, a geologist, and, he also added, a hydraulic engineer. Well, I am perfectly sure that these ladies between them can carry out all the investigations necessary under the first four headings mentioned, but I am not quite certain about the hydraulic engineer aspect. However, here we have before us the greatest authorities on this subject up to date. I may say that the fate of Lake Moeris itself trembles in the balance. Let us hear what they have to say, but before they commence I should like to point out that the paper is a joint paper, and it will be read by Miss Caton-Thompson.

Miss Caton-Thompson then read the paper, and a discussion followed.

Sir HENRY LYONS: I should like, first of all, to offer my very sincere congratulations to the authors of an extremely fine piece of work. I have always been convinced that if we were to do anything on the margin of the desert, that very unpromising and at the same time very attractive region, it would only be done by the joint employment of a geologist and an archaeologist supplemented by careful surveying and levelling, and that is exactly what we have had laid before us to-night. I am sure you will realize how difficult a task it must have been to disentangle the evidence that lay hidden in those gravel-strewn slopes along the north margin of the Faiyum. I must confess that I never was wholly satisfied with any of the earlier explanations given for the past history of the Birket el Qarun and its predecessor, Lake Moeris. The enormous amount of detail we have had put before us this evening will require very careful reading and examination, but as I have heard it this evening it certainly is a far more attractive and far more convincing sketch of the past history of that part of the Nile Valley than I have hitherto met with, and I believe that as one reads the paper again one's feeling in that direction will extend further. I hope Miss Caton-Thompson and Miss Gardner may have time in the future to attack other areas on the desert margin of Egypt. I am sure in numberless places there is evidence, and plenty of evidence, of its Pleistocene history and the post-

Pleistocene occupation of the margin by man. Such research, however, does not offer any of those spectacular prizes that similar work in the valley of the Nile usually does. I think that the authors have really added a very valuable piece of early history to the geology and the archaeology of Egypt, and I am sure that their systematic work on this comparatively restricted area will set a standard and an example for other work on the same lines in neighbouring regions.

Dr. K. S. SANDFORD: I would like to take my part in congratulating the authors of this paper on a fine piece of work. The north side of the Faiyum is not altogether a pleasant place to work in, and at times, as I know, it can be distinctly uncomfortable. The lakes themselves are, as you have seen, exceedingly complicated, and I have listened with the keenest interest to the remarkable account of them. I remember seeing the remarks of another person who had tried to work out the problems of the Faiyum lakes. He tried very hard, and in the end he threw up his hands and said, "It is impossible; there is a multitude of lakes," and so, apparently, there is, but the authors of the paper have done much to sort out that multitude. Perhaps I may be allowed to say a word for those early investigators of the region, Sir Hanbury Brown and Beadnell, who, working twenty-five and thirty years ago under exceedingly difficult conditions, laid the foundations. Maybe they made the problems worse in some ways, but their researches in Lake Moeris were only incidental to professional work. They worked under pioneer conditions and made a very valuable reconnaissance. That is, of course, quite obvious from what has been said this evening, and nobody would say so sooner than the authors of the paper.

Two points have been of interest to me: first of all, the inception of desert conditions in Egypt and in North-East Africa in general. I know that desert conditions became serious in the northern part of Egypt fairly late in Palaeolithic times. In company with Mr. W. J. Arkell I have been working in Upper Egypt for a year or two, and we are gradually making a survey of the Nile basin, from the First Cataract at Aswan right up to the Mediterranean. We have found that beyond a shadow of doubt desert conditions started in the south much earlier than in the north; we may say with the close of Mousterian times. That is exactly what we would expect, but it is of some interest to find it is so.

The second point deals with the performance of the Nile itself. Mr. Arkell and I have completed a study of the aggradation and degradation in that region of the Nile valley opposite and just inside the Faiyum; we have studied these movements in the south also but find they do not there behave in quite the same way. It is a fact that the Nile aggraded its bed quite late in Palaeolithic times in Upper Egypt, piling up silts and clays to a height of some 50 feet above the present level, mounting up over old terraces. Farther north we find those silts disappearing below the modern alluvium. Still further north we see a trace of them again, and there is ample evidence that while silts were being piled up in the south the Nile was actually eroding its bed in the north. That complicates the position, of course, but it is an undoubted fact. In conclusion, I would like, once more, to congratulate the authors of the paper upon their splendid work.

Professor SELIGMAN: I would like, first of all, to pay my tribute to the work that these two ladies have done. I think we should also bear in mind the prescience shown by Sir Flinders Petrie when he selected Miss Caton-Thompson and, later, Miss Gardner and started them on this exceedingly interesting piece of work which they have carried out so well. As an ethnologist, I recognize that they have opened up a number of extraordinarily interesting questions, they know that perfectly well, and they know something of the solution of some of them, but I suppose they thought it was hardly fit to bring these problems before you to-night. I must, however, say something about them, if I am to say

anything at all. We all knew of these stone implements as existing in the Faiyum, and vaguely grouped them with the Neolithic of North Africa, but we had no idea of the actual civilization to which they belonged. We knew nothing about the pottery, and we could only conjecture the implements were used by a people who had fields of grain. Now Miss Caton-Thompson has laid bare the greater part of their material culture, excepting only that she has not found their cemeteries. We know, however. that they were agricultural people, and the deposits the authors have investigated show that they do resemble the Neolithic people of North Africa with, perhaps, distinct resemblances in the typology of their implements to those discovered at Siwa. That in itself is a very great step in advance. Yet the authors have merely accentuated certain outstanding difficulties. It has always been a problem why these very distinctive implements—they are extraordinarily typical; I think you can pick out Faiyum flints from those of any other part of the world—do not come across that little ridge of land into the Nile Valley. The question is: did those people really get into the Nile Valley and have their remains been covered up by subsequent deposits? or were they really cut off from the Nile Valley during the time that they were making those innumerable flints?

We very much want to know whether these people did lap over into the Nile Valley, and, if they did not, what was the factor that prevented them? Because it is one of the most extraordinary instances, as far as present knowledge goes, of a very definite culture with a strangely circumscribed distribution, for I expect Miss Caton-Thompson will agree with me that the few arrow-heads of Faiyum type found in Badarian settlements and graves do not prove that the Badarian people were direct descendants of the Faiyum people or that there was any direct continuity. This is the most outstanding ethnological problem, and it only remains for me to express again my admiration for this extraordinary well-done piece of work.

Mr. H. W. SETON-KARR: More than twenty years ago I made several expeditions for archaeological purposes into the Faiyum desert. I had noticed that the native dealers in antiquities had some very beautiful arrowheads said to come from there. I found them scattered about the dry bed of part of the ancient lake. Material in the shape of hard tabular flint happens to occur here. From the sites of some of the ancient settlements I took to the Cairo Museum a number of heavy mealing plates for grinding corn, which were exhibited for some time in the prehistoric gallery. Some questions which puzzled me about the lake-levels have been made clear by Miss Caton-Thompson's able paper.

The PRESIDENT: We have listened to an exceptionally interesting lecture, and you will agree with me that Miss Caton-Thompson and Miss Gardner have carried out a remarkable piece of work, which, as I said when I introduced them, involves a united acquirement of those "ists" which they undoubtedly possess. Well, we must now all unitedly drop a tear for the loss of the old large, historic Lake Moeris; but whilst we drop that tear we remember that we have still left to us that high-level Palaeolithic lake. We remember also that this lecture on historical geography had its basis in prehistoric geography; and that is a section of geography which hitherto has not found its way into geographical congresses. I am sure if Miss Caton-Thompson and Miss Gardner lecture before the next Geographical Congress we shall have another Section entirely devoted to prehistoric geography. We are most indebted to them for their admirable lecture and congratulate them very heartily on their persistence, on the great ability which they have shown, and the interesting results which they have described to us to-night.

NOTES ON A VISIT TO THE DEPENDENCIES OF THE FALKLAND ISLANDS

Extracted from a letter of H.E. the Governor,

ARNOLD HODSON, C.M.G.

I LEFT Port Stanley on 2 February 1928 by the S.S. *Fleurus* to visit the Dependencies, making first for the South Shetlands. These islands are very similar to the other groups in the Dependencies—grand rather than beautiful. Some people call them ugly, but their wildness, barrenness and aloofness give them a strange charm of their own. The entrance to Deception Harbour is very narrow and bounded by precipitous cliffs on each side. It is a veritable death trap to the uninitiated, as there is a hidden rock right in the middle of the entrance. Buoys have been attached to it several times, but the gales always break them away, so it is now unmarked. It is therefore necessary on entering to hug the right-hand cliff, which rises sheer and precipitous from the water to a height of 400 feet. One then enters a great crater basin, which has been filled by the sea and is very deep. Inside the harbour winds shriek and tear round almost without ceasing. Once a large iceberg came inside and threatened the factories. All the little catchers were employed to try to push it away, but without any effect. So the ships had to up-anchor and steam out. Owing to the hot springs the harbour is generally covered by a misty cloud. Deception is an excellent harbour: the great drawback is the tremendous depth of the water, which makes it difficult to drop anchor.

Captain Öhre, the manager of the Hektor Company, told me that on 4 January 1925, about ten o'clock in the morning, while he was on shore an earthquake suddenly started, so that only with the greatest difficulty could he stand up. Half the harbour boiled up to a height of about 5 feet, whilst the other half remained calm. A large part of the beach near the factory broke off and slipped into the sea, and the bottom of the harbour near this point dropped 6 fathoms. The anchor chains of the steamers were all twisted up and entangled. Nearly every morning steam can be seen rising from the beach and the volcanic lakes.

This year the ice conditions were remarkable. The South Orkneys had in the middle of February only recently been opened, while the South Sandwich Islands were still icebound. The ice-pack was still just below the Orkneys. An enormous number of whales have been in the area between the South Orkneys and the South Sandwich Islands this year. The factories have in consequence all been fishing there. They take great risks, for they try to lie up just outside the ice-pack and float with it, but very often ice closes in on them and they are caught. The *Professor Gruvel* was sunk early in the season, and the *Southern Queen* in February, and in addition the *Maudie* and *Pythia* were badly damaged, the latter so much that it is doubtful whether she will be able to leave the Dependencies. To all intents and purposes, all these vessels are pelagic, and only require to use the land harbours to which they are entitled for coaling and watering.

It would appear that every year the ice is getting farther north. It is certain from old records that in the past it did not reach nearly so far north in the summer months. Bellingshausen visited the South Sandwich Islands on

3 January 1820, Fanning on 8 December 1830, Larsen on 9 November 1908 and Filchner in November 1911, whereas this year they were still icebound in February.

We left Deception Island on February 12 and made a short trip through Belgica Strait and Neumayer Channel, as far as Anvers and Wiencke Islands. So far as we could see, the ocean outside was clear, except for a few icebergs, but time did not permit us to go farther. On our return to Deception Island we passed the island called Intercurrence which our captain informed us was, by his reckoning, 15 miles out of its position as marked on the chart. After a night's stay at Deception Island, we set off for the South Orkneys. Encountering a great ice-field, we altered our course more to the west towards Elephant Island. We steamed to the south of this island, but soon got into the pack—surely a remarkable thing considering it was February. After a narrow escape we reached the open sea once more. The whole way to the Orkneys, which we reached on February 17, we continued to meet ice.

I was told of a strange thing which happened to the captain of a catcher. He was tearing along as usual in thick fog, with his harpoon gun loaded. Suddenly an iceberg loomed ahead. By reversing the engines he just managed to avoid a collision, but it was so close that the harpoon went into the iceberg and remained there. This sounds like a fisherman's story, but it is perfectly true.

We reached South Georgia on February 22, and anchored in Grytviken Harbour. On arrival we were received by Mr. Alison, the magistrate, and the whaling managers. They gave me a salute of seventeen dynamite blasts carefully laid on the top of a small hill near by, and all the catchers were gaily decorated with flags.

Next day the sports meeting was held on an excellent ground. When we were all assembled, the athletes, who were congregated in the Norwegian church, came out in a long procession headed by a band. They looked very smart in their sports kit. Each whaling company had its own band of athletes headed by a flag-bearer with the company's flag. This Norwegian church, the most southerly in the world, seems to be used for many purposes. It is here they hold their cinema meetings. There used to be a clergyman, but it is stated that when the whalers went to church they demanded to be paid overtime! The procession walked round the field twice, drew up in front of me, and gave a salute. Then the sports began before a large crowd. Later in the morning I went across the bay to open the new rifle range, which is a splendid one, with first-class disappearing targets, and extending up to 500 yards.

The next morning I proceeded by motor launch from the Government headquarters at King Edward Cove, Cumberland Bay, across the harbour of Grytviken to the jetty belonging to the whaling factory of the Compania Argentina de Pesca. I was met by all the whaling managers at South Georgia, by representatives of their employees, and by a detachment of officers, scientists and men from the *William Scoresby*.

Shackleton's grave lies in a small enclosed cemetery on the foreshore of the southern waters he knew so well and loved. It is impressive in its simplicity and borrows dignity from the grandeur of its surroundings. By its side I first read the service, which was printed both in English and in Norwegian, the stone being draped with a large Union Jack. At the end of the service I pulled

Entrance to Deception Harbour, South Shetlands

Grytviken, South Georgia

Whalers dressed for Governor's visit, Grytviken

Norwegian church, Grytviken

Whaling factory, South Georgia

The Governor unveiling the memorial to Sir Ernest Shackleton

the retaining cord, and thus releasing the Union Jack disclosed the rugged and beautiful stone of grey granite inscribed merely with the name and dates of the birth and death of the great spirit whose mortal remains had been laid to rest beneath it. I then placed on the grave one of the two wreaths sent out from England, the other being placed by Mrs. Alison, the only lady resident in the Dependencies. The service was attended by upwards of a hundred persons and was followed with marked reverence by all, who were obviously glad to have this opportunity of paying tribute to one whose greatness none can truly appreciate better than they themselves.

While at South Georgia I had the pleasure of meeting a party of men who had just come from the Argentine Station on Laurie Island. I was informed on reliable authority that a special vessel is being sent by the Argentine Government to Laurie Island next year to erect new buildings. They gave me some photographs showing the type of wireless in use there. The next morning I went out in a whale catcher southwards round the coast, passing Cape George. Just off this cape there is a rock finely pointed like a pencil. It does not show above the water except when there is a heavy sea running, and it can sometimes be seen in the trough of the waves. It is not marked in any way and is a real menace to shipping. We landed at Hundebukten Bay and crossed the mountains to the other side, through very wild and rugged scenery, where we rejoined the catcher.

We left very early the next morning in the *Fleurus* for Port Stanley, which we reached on March 1.

WATERFALLS IN NORTHERN RHODESIA

THE discovery that the Kalambo Falls, though perfectly well known to the inhabitants of Abercorn, were not shown on any map, and only casually referred to in one or two books of travel (*G.J.* 67, 1926, pp. 68, 248–51), has brought us information on other Rhodesian falls hitherto undescribed. We are particularly indebted to Captain H. R. Harmer for a whole series of letters describing a group of falls at the southern end of Lake Tanganyika, and brief references to large falls east of Broken Hill, on which we have earlier information from Mr. F. E. Kanthack.

Captain Harmer's most important letter is dated 29 August 1927 from Mpulungu Harbour, Lake Tanganyika, and enclosed a roll of undeveloped films which proved disappointing, some being under-exposed, and the most interesting having a double exposure.

I set out from Mpulungu for Kalambo by canoe, and after six hours of hard paddling arrived at Chepwe's village in Tanganyika Territory. The hour was late and the natives were not encouraging, so I returned. Before doing so I took exposures of the Kalambo gorge entrance on to Lake Tanganyika.

My next journey was to explore the falls, for which I propose the local vernacular name of Chirombo. These falls are 880 feet high and 20 feet broad, and are not, strictly speaking, one direct drop. At 430 feet the small ledge gives the falls an extra jump forward. They may be in a broad sense referred to as one direct drop, as the ledge is not prominent.

I am sorry to say that very few people will be able to enjoy the view for themselves; to obtain an absolutely superb view would necessitate three hours' climb to a height of a little more than 2000 feet above the lake in 2 or 3 miles; another view-point is reached in one and a half hours, and is 1800 feet above the lake. I was not able to take a picture of the full view because my carrier, who was in charge of the camera, had temporarily lamed himself and was not able to proceed, so I was forced to return.

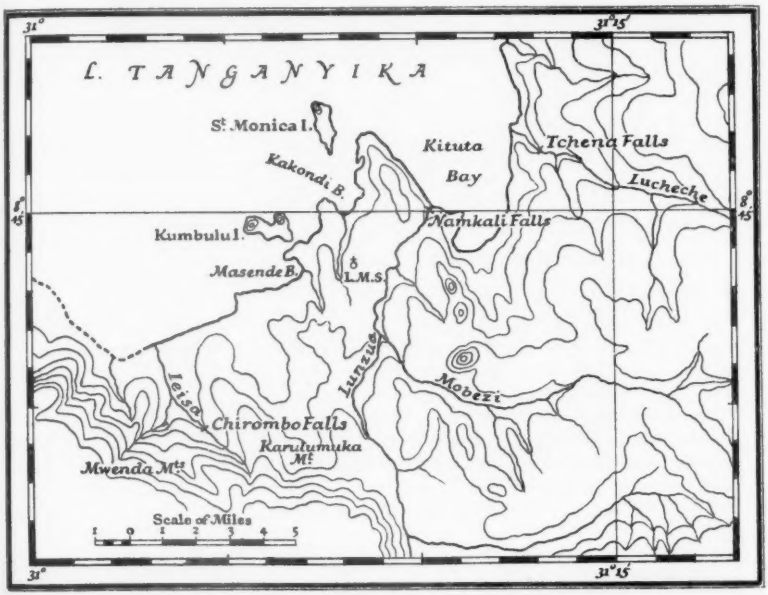
I have never in the whole of my experience seen a more majestic and rugged scenery than that which was opened out before me at Chirombo: a deep gorge on one side, rugged steep cliffs along the shores of Lake Tanganyika on another, and right before me the whole magnificence of the lake, with Kalambo gorge in the far distance; the Isle of St. Monica somewhat nearer, with Kambula and Mpulungu Harbour at the foot of the mountain. All this is to be seen from the highest point of the Mwende Mountains. In my opinion the Chirombo Falls are a far more wonderful sight than Kalambo, but I have not yet come across a white man who can compare the two falls. One actually lives at the foot of the mountain on the lake-side, growing coffee, and he has lived there for several years but he complains that the climate is too severe. The top of the falls, 50 feet of it, can be seen from his house. The carriers who accompanied me on all trips express their opinions by saying the Chirombo is ukalambo (big) and the Kalambo is unono (small).

The last journey, that to Kalambo Falls, was perhaps the most interesting. I went overland, passing through Niamkola and Kapatwe villages in Kakonde Bay, over the Kakonde stream and onwards to Kapata's village on the western shore of Kitutu Bay. Just before this village I found a very beautiful fall, for which I propose the name Namkali. The height is 26 feet, and it is 31 feet broad. The volume is immense, falling into a quiet pool flanked on one side by cliffs of sandstone and downstream by tropical foliage. The spray from these falls is rather heavy; the river is the Lunzua, which has many little waterfalls but none as beautiful as this.

The river flows through a valley prior to its discharge over the falls, and while leading from the Mwende Mountains it is really subterranean for some miles beyond them. Many of the streams between Abercorn and Mpulungu disappear underground before entering the lake.

Crossing over the Bay from Kapata's village to the now deserted "harbour" or calling-place at Kitutu, I noticed on my right the abandoned vessel of the African Lakes Corporation, called the *Good News*. The local natives have removed a great deal of the ironwork and have beaten the pieces into axe-heads and hammers.

Continuing along the African Trans-Continental Telegraph Co.'s line for some miles I passed over a pretty stream called Muswela, and passing through Kowe's village near the Lucheche river, walked up-river to some falls called by



Positions of waterfalls in Northern Rhodesia

the natives Tchena. These falls are about 18 feet high and 30 feet broad. I continued onwards from here to Chisanza's village, and abandoning the Telegraph line walked over the Kaquvelawala Mountains to Kalambo Falls. Just before falling over the lip to the gorge the river is strangely placid, and I feel sure that one, passing down the river by canoe, would be alarmed at the strange stillness.

Eight feet from the edge the water narrows to 20 feet and drops 1 foot, and continues for 8 feet into an opening or channel 6 feet wide which in itself falls 2 feet 6 inches to a ledge 12 feet broad, 1 foot wide; this ledge helps to throw the volume of water out some considerable distance down to the valley below.

The height of these falls is 740 feet, and the water does not reach the bottom as water, but as heavy rain. This rain begins some 80 feet from the ground below. In the rainy season the falls show every indication of being 60 feet wide.

At the edge the Tanganyika side is close against the fall, but the Northern Rhodesian section widens very suddenly to 2400 feet. The gorge is 900 feet deep, and maintains an average width of 1800 feet at the top until it reaches the lake-shore. The river after its long drop becomes 20 feet wide and meanders through the gorge at a very lazy pace. The cliffs are sandstone and have innumerable clefts in the sides; on the Tanganyika side the grey monkey abounds, and on the N. Rhodesian many storks are to be seen.

Name.	*Position.*	*Dimensions.*	*Altitude (aneroid reading).*
Abercorn Boma ..	—	—	5700 feet.
Mpulungu Harbour ..	—	—	3000 „
Kalambo Falls ..	long. 31° 13′ 31″	Height 740 feet	4400 „
	lat. 08° 34′ 53″	width 6 feet, widens to 12 feet	
Tchena Falls on Lucheche River ..	long. 31° 13′ 08″	height 18 feet	Not recorded.
	lat. 08° 43′ 29″	width 30 feet	
Namkali Falls on Lunzua River	long. 31° 10′ 14″	height 26 „	3100 feet.
	lat. 08° 44′ 52″	width 31 „	
Chirombo Falls on Ieise River	long. 31° 04′ 34″	height 880 „	4800 „
	lat. 08° 50′ 38″	width 20 „	

The longitudes were obtained with half chronometer watches.

Further information on the Chirombo Falls is given in a letter from Livingstone dated 8 December 1927:

It is very disappointing to hear the exposures of the Chirombo Falls were a complete failure; it is entirely my own fault. I was very excited and, of course, very careless. I have just returned from another trip to Lake Tanganyika, and once again visited the Chirombo.

On November 6, in the early morning, I set off on a trip to Chirombo, with the object of obtaining a really good full-length "view" of the Falls. I certainly obtained some excellent exposures of them, but my bearer dropped the exposed films over the first cataract of Chirombo. I doubt if the opportunity will occur this year for another visit. However, I shall return during the first quarter of 1928.

The Chirombo Falls descend over an escarpment, and continue as a series of cataracts or minor falls to the lake-side. There are no less than fifteen independent groups of cataracts, distributed over a total distance of 2 miles downstream from the Falls. The first cataract descends 700 feet in as many yards. The waters rush with tremendous force through many caves: it is common to observe water pouring out of a fissure in a huge boulder and dropping 30, 40, and 50 feet, while the main stream runs some 20 or 50 feet away.

The second cataract descends 100 feet in 300 yards; the remainder of the groups are of varying size. The vegetation is very dense, and the sides of the gorge are precipitous. It is difficult to negotiate a passage along the course of the river to the falls—a hatchet is required, and at the second cataract you must abandon your usual footwear and proceed in socks or don some soft-soled mocassins so as to scale the various rocks and boulders, which are serious obstacles. The actual jungle is not very pleasant, but there are many beautiful birds and a number of blue colobus monkeys living in it. I believe Mr. Gilman spoke of the *Uapaca Kirkii* as stopping at the southern foot of the Pitu Range. I have found them almost everywhere, at Kasama, Kasanga (Bismarckburg),

Part of the Chirombo Falls

The Namkali Falls, Lunzua river

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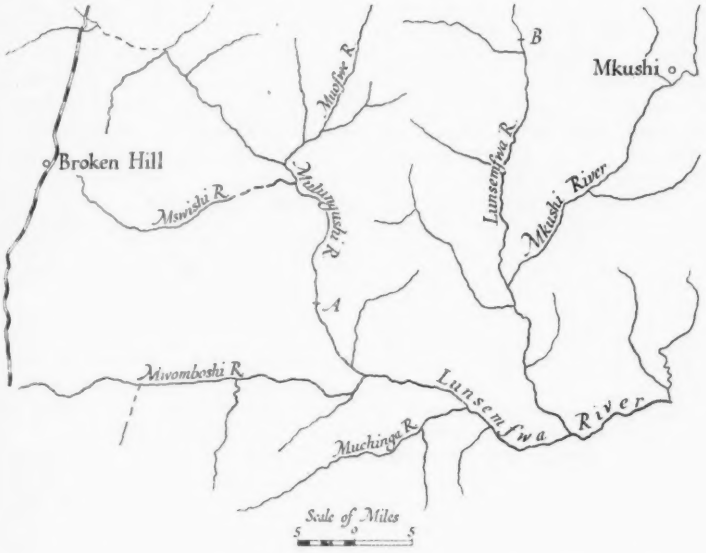
The Mulungushi Falls

Abercorn, Fort Rosebery, and in Katanga. I have always considered the *U. Kirkii* to be a widely distributed tree. It is very numerous in Portuguese Zambezia, and near the Limpopo.

Near Niamkola there is an old ruin of a church. Gore-Browne in his book 'The Crater' describes it as an old White Fathers settlement overrun with all sorts of objectionable beasts, especially lions, leopards and snakes. It is the most inoffensive spot in the world, the only wild game Water-buck (*Cobus ellipsiprymnus*). The ruin is not White Fathers but London Missionary Society.

Towards the left of Chirombo, about 4 miles along the lake-side, there are some falls called Msmela, by the natives, which are situated on the river Lofu (I am not sure of the river's name); these falls are a few hundred feet in height, and have a number of cataracts.



In a third letter from Livingstone dated 14 January 1928 Captain Harmer sends more photographs of Chirombo, and several of the Mulungushi Falls "at the hydro-electric power station." For some time we had been seeking an account of these falls. In response to an inquiry in June 1926 Mr. F. E. Kanthack had written from Johannesburg on July 15:

Maps of Northern Rhodesia are very bad. I am enclosing a copy of Degree Sheet NW15 (provisional issue), which is the only map I have for the moment in my possession, and I have shown thereon as near as possible (A) the Mulungushi Falls, and (B) the Falls on the Lusenfwa.

The Lusenfwa Falls were investigated a few years ago by Mr. Elsdon Dew, Electrical and Mechanical Consulting Engineer to the Central Mining and Investment Corporation, Ltd., in connection with power projects for Broken Hill, and he gave me the following information: Approximate height 400 feet. Situation about 1 mile downstream of the point where the track from Broken

Hill to M'Kushi crosses the Lusenfwa. The Lusenfwa does not drop right down to the bottom of the escarpment at one fall, but takes several plunges. The fall marked B is the biggest, and this is followed by pools, rapids and smaller falls. The Lusenfwa is a much bigger river than the Mulungushi, and has a much greater discharge in the dry season. Mr. Elsdon Dew covered a great deal of this country during his explorations on a bicycle, and recorded the following mileages: Broken Hill to Lusenfwa Falls, 57 miles; Lusenfwa Falls to Mulungushi Falls, approximately 30 miles. The distance from Broken Hill to the Mulungushi Dam is exactly 36 miles along the new metalled road. The Falls are between 4 and 5 miles downstream of the dam.

We had delayed publication of this note in the hope of receiving more complete information; but this has not come, and it seems well to publish now the little we know of these important falls. It is a curious commentary on the unmapped and undescribed state of Northern Rhodesia that a waterfall may suffer the indignity of being harnessed almost before its existence is made known. The name "Lunsemfwa River" on the sketch-map is taken from the Northern Rhodesia Provisional Sheet N.W. 15. We cannot at present explain the difference between that and Mr. Kanthack's rendering "Lusenfwa."

THE WRECK OF THE *ITALIA*

THE TRAGEDY OF THE ITALIA. With the rescuers to the Red Tent. By DAVIDE GIUDICI, Special Correspondent of the *Corriere della Sera* on board the *Krassin*. *London: Ernest Benn, Ltd.* 1928. 9×6 *inches; pages* viii+216; *map and illustrations.* 12*s* 6*d*

THE ill-fated enterprise of the *Italia* revealed the special dangers that beset any expedition of which the personnel is international. When they come to grief, the risk of recrimination is greatly increased. It so happened that when the airship *Italia* was wrecked and a great part of her complement ultimately rescued in dramatic style by a collaboration of ice-breakers, aeroplanes, flying-boats, and radio stations, the principal part was played by the Russians, and only their press received full accounts; but the death of a Swede started a campaign of criticism in Scandinavian and Continental papers which rapidly became malevolent, while the rather chilly accounts of the affair published in a leading London paper by a Czech participator did little to defend the Italian cause. For this reason we have foregone any mention of the *Italia's* fate until we might have an account of these very extraordinary events from the pen of a sympathetic onlooker. Such was Signor Davide Giudici, the representative in Berlin of the *Corriere della Sera*, who had the good fortune to be the only non-Russian correspondent upon the ice-breaker *Krassin*, and who has now published a book that will rank high in the annals of polar adventure. If it has appeared in Italy there is no indication of its Italian title on the excellent English translation now published by Messrs. Benn. A publisher's note on the dust-cover speaks of it as translated, but does not say by whom. We must not fail to congratulate translator as well as author. Their joint labours have given us a narrative which is admirably arranged and phrased, nearly unsentimental, well proportioned, accurate in scientific phraseology, and generally as unlike many narratives as it well could be.

The *Krassin*, which had been built on the Tyne during the war for service with the Allied forces at Murmansk, had been laid up for two years at Saint Petersburg, yet was fitted out and provisioned in five days with everything

except coffee. The leader was a geologist, Professor Samoilivic, who was controlled by a Commissar, Commander Oras. These two with the airman Chukhnovski formed the "directorate" under whom the captain of the ship, Eggi, carried on his technical duties. At Bergen she took on Cardiff coal, and her already overcrowded mess-room now welcomed Professor Hoel, the Director of Svalbard scientific services, and Signor Giudici. With 28 officers, specialists, and reporters, and a crew of 110 men, the *Krassin* sailed from Bergen on June 24, six days after the ill-fated Latham seaplane had set out from Tromsö.

In a brief introduction Signor Giudici gives a short account of the *Italia's* career before wireless communication ceased on May 25 and her failure to return to Spitsbergen caused acute anxiety for her fate. On May 27 he was ordered to Oslo, and in chapter i gives an interesting account of the prompt measures taken by Norway to send relief. Sverdrup had already suggested an ice-breaker, and Hoel supported him, but there was none available in Norway, so for the time they concentrated on naval seaplanes. But Sverdrup had, at the request of the Russian Government, already commanded the *Krassin* (then the *Sviatogor*) when in 1920 she rescued the crew of another ice-breaker broken down in the Kara Sea. He urged that the *Krassin* was the ship to send, and the decision to send her in time was due primarily to his clear appreciation of the situation. Meanwhile, on June 8, the first message from the *Italia's* wireless, picked up by a farmer in the district of Archangel, an amateur who got rather tied up in receiving a message referring to the " Tierra Francesco Guiseppe," gave the position of the survivors as near Foyn Island. Norwegian, Swedish and Italian aviators had gathered in numbers on the north coasts of Spitsbergen; at least half a dozen ships were trying to force their way through the pack; and General Nobile, carried off by the Swedish airman Lundborg, was already on the *Citta di Milano* at King's Bay when the *Krassin* left Bergen.

The most curious feature of the *Krassin's* voyage was the reluctance, indeed at first the refusal, of the Norwegian radio-station at Green Harbour to communicate with her or to accept messages. The Russian journalists could send to Moscow by a relay from the *Malyghin*, another Russian ice-breaker, from Archangel, operating east of North-East Land: a vessel of which at the time we heard little, but which played an important part in the operations. The representative of the Milan paper had great difficulty in getting his dispatches through, which accounts for the fact that outside Russia there was not much heard of the *Krassin's* voyage at first.

By July 3 the *Krassin* was off Cape Platen, and then she was blocked for four days, with a blade of one propeller gone, and her rudder badly damaged. The Red Tent, with Viglieri and the other survivors, was only some 70 miles away; it was time to bring the aeroplane into action. On July 8 Chukhnovski made a trial flight, and on July 10 he went off and did not return. Fog had come down; he could not find the *Krassin* again, but made a forced descent on North-East Land due south of the ship. He was able to report, however, that he had located the Malmgren party, and had circled over them several times, though he did not venture to drop any of the supplies carried for them because their ice-floe was so small. He described two men standing up and waving and a third lying on the ice, which was a mistake, for Captains Zappi and Mariano had at his own request been forced to abandon Dr. Malmgren four weeks before; though they had made little progress towards the land they had drifted about a great deal, and must have become separated from the corpse of their companion.

On receipt of this news the *Krassin* cast off her ice anchors and got up full steam for the rescue of the party only some 13 miles away, which they accomplished at 5.20 on the following morning after some delicate manoeuvring to

avoid upsetting the small floe at the last moment. By incredible good fortune the two officers had survived on the ice, one of them at last lying in water, about twelve days since they had finished the last of their food, and Captain Zappi was strong enough to get aboard without assistance and to tell something of their story. Malmgren, who had urged the attempt to get a small party ashore to summon help for the others, had underestimated the damage that he had suffered in the crash; it soon became clear that he could not go far, and he insisted that the others should take what food there was and go forward.

Without delay the *Krassin* stood on eastward to the reported position of the Red Tent and the Viglieri party only 30 miles east and 1 north; but they could not be found in that position, and probably would not have been found at all had they not been able to inform the *Citta di Milano* by radio that the *Krassin* had passed east of them, which information being transmitted by the former to the latter, the ice-breaker requested the base-ship to instruct the party to make smoke signals. This had immediate success, and within an hour or two they were all picked up, none of them, it would seem, in a very bad case.

Then came the delicate decision whether to carry on the search for the balance of the *Italia's* crew that went away in the keel when the gondola was smashed, or return for the benefit of Captain Mariano, in urgent need of skilled surgery. They took the latter course, and thereby lost, in Signor Giudici's opinion, any faint chance they might have had of finding the Arduino party. How very small a chance it was may be estimated from the difficulty of finding the Red Tent even when its position was approximately known. Of the airship's adventures after she dropped the gondola nothing whatever was known beyond the baffling indication of a column of black smoke seen to rise in the east soon after she had disappeared. When the *Krassin* got back again to the scene of her earlier successes, after two months' delays in repairs, coaling, watering, and succouring a large German tourist ship in difficulties, it was on a forlorn hope. They carried the search in a great zigzag as far as Franz Josef Land, and barely extricated themselves at the end of September. It was a gallant effort, and we are certain that Signor Giudici's judgment does not imply any criticism of the people that carried off all the principal honours in the competition.

It must have been observed before now that the laws of chance do not run in the polar regions. The gondola containing ten men was smashed to fragments when the airship hit the ice. Only one was killed, and only two badly injured. When they came to take stock of the stores that had been scattered from the gondola and those that had been thrown out instantly by Arduino when he saw what had happened, they found that they had a tent, two months' food, petrol, matches, a pistol and ammunition, navigating instruments, and a wireless apparatus so little damaged that it would not only receive but transmit, with the operator Biagi so little shaken that the same evening he had the apparatus working. Very soon they learned from the *Citta di Milano* and from the San Paulo station at Rome all the excitement they had made in the world, but for a long time they could not get messages through, though Biagi ran up and down all his scale of wave lengths. At last the base-ship heard him, and from that time the wireless began to play a more normal part in the complex operations.

The party on the ice knew all about the arrival of relief ships and aeroplanes, and very soon they saw the latter flying all round about them four or five a day without spotting them, despite all they could do to attract their attention. First came the Norwegians Rijser Larsen and Luetzow Holm, taking the greatest risks with their machines of small range. Then came their compatriot Maddalena, who at the fifth attempt, guided by wireless signals from Biagi's "little box" relayed by the ship, succeeded in dropping supplies for them, and

collapsible boats for an eventual advance to the shore if the ice broke up. Then came the Swedes, who not only provisioned them but insisted on carrying off their General as the man best qualified to direct the whole operations of the relief. Within a few hours Captain Lundborg had come back again and crashed in landing, thereby exchanging himself for the General and introducing "a new and restless element into the daily life of the group." But very soon Lundborg was rescued by his compatriot Schyberg," who never appeared again, although his base was on the little island of Eismark, a flight of barely fifteen minutes from the Red Tent," and the Viglieri party from that time onward placed their greatest hopes in the Russian vessel, because the variable weather greatly reduced the possibility of rescue by air. Happily this hope was well founded.

Some of the critics who watched this extraordinary sequence of events as it was scrappily and inadequately reported at the time were inclined to carp at the relative insuccess of the aeroplanes and seaplanes, but it must be remembered that they had at any rate two successes perhaps indispensable: Maddalena brought supplies at a critical time, and Chukhnovski discovered Zappi and Mariano when they could not have survived more than a few days. The difficult task of deciding on the large general questions of principle involved has been undertaken by a strong Italian commission, which includes the ex-President of the International Geographical Union. Their report will doubtless elucidate certain aspects which are still obscure. Meanwhile we may be grateful to Signor Giudici for his singularly lucid, skilful, and impartial account.

A NEW THEORY OF THE DISCOVERY OF AMERICA

LA GENESE DE LA DECOUVERTE DE L'AMERIQUE d'après des documents recemment retrouvés. La Pré-découverte faite par Colomb en 1477. Par LOUIS ULLOA. *Paris: Société de Géographie*, 1928. 9×6 *inches;* 29 *pages*

IN a previous work, 'Christophe Colomb Catalan' (noticed in the *Journal* for May 1928), Señor Luis Ulloa has argued that the discoverer of America was a Catalan and that his true name was Juan Colom. He goes very much further in the present essay, and as the conclusions reached are somewhat startling we may begin by setting forth Señor Ulloa's arguments in some detail, using his own words as far as possible.

"J'ai pu," he says, "constater que quand Christophe Colomb . . . s'est présenté . . . aux Rois Catholiques pour leur proposer les *Capitulations*, il avait déjà été en Amérique. . . . Sur quelles preuves je me suis appuyé pour établir un aussi grand fait? Sur le même texte authentique des *Capitulations* avant tout" (p. 8). This authentic text, he proceeds, is the copy found in the Archives of the Crown of Aragon, which states, as Bergenroth first noted, that the grants made to Columbus were in return for that which he had already discovered, "de lo que ha descubierto en las mares Océanas" (p. 8). Navarrete, who first printed the text of the *Capitulations*, having found this past tense in the copy in the Archives of the dukes of Veragua, changed it into the future, "ha de descubrir," regarding "ha descubierto" as the obvious error of a copyist (pp. 8, 10). But this explanation, we are told, cannot be accepted, since the document in the Archives of Aragon is the original (p. 10). Equally unsatisfactory is the explanation, first put forward by Aaron Goodrich and sanctioned by Vignaud, that Columbus was lying, representing himself as having accomplished a voyage which had, in

fact, been accomplished by "the mysterious pilot"; the story of the pilot, as told by the chroniclers, will not bear critical investigation (pp. 11–12). Nor can it be that Columbus lied from vanity, as Señor Altolaguirre has suggested; the lie would then have appeared in contemporary writers (p. 9). It therefore follows that there was no lie, and that prior to 17 April 1492 Columbus had already been in America. This is borne out by other facts. In the *Journal* of the first voyage, Columbus reveals a knowledge of the winds and of their effect upon navigation, which could only have been the result of experience (pp. 13–14). He held steadily to a given course, which shows that he knew exactly what he was to reach (pp. 14–18). When he reached Cuba, he believed it to be the mainland and yet did not remain there, but went on in search of something else, which proves that he was seeking Española (p. 17). "Arrivé ensuite á un point déterminé de la côte septentrionale de l'Ile, il dit sans hésiter: j'ai trouvé ce que je cherchais" (pp. 17–18).

At a later period Columbus insisted that it was in his power, after God, to give the lands which he had discovered to any prince with whom he might make an agreement, and that he alone was able to give these lands to the sovereigns. "Qu'est-ce que cela peut bien signifier? Cela saute aux yeux; il n'y avait, avant 1492, aucun autre homme au monde que Colomb qui connaissait le secret des Indes; . . . il n'y avait que lui qui, avant 1492, s'y était rendu" (p. 20). In the suit which he brought against the Crown, Diego Columbus equally insisted that his father was solely responsible for the discovery of the New World, and the royal proctor did not attempt to controvert this assertion (p. 20). Finally, in the codicil of Valladolid, there is to be found "un témoinage plus décisif. . . . La Codicile porte cette clause vraiment extraordinaire dans sa simplicité: A Diego, mon fils, j'ordonne qu'il subvienne, dans une chapelle qu'il se chargera de construire, aux besoins de trois chapelains . . . et, si cela est possible, *dans l'ile Espagnole, que Dieu m'a donné miraculeusement; il me plairait que ce fut à l'endroit ou je l'ai invoqué* (*la sainte Trinite*), *c'est-à-dire dans la Vega* . . . qu'on nomme de la Concepcion" (p. 20). The word "miraculously" has been taken to refer to the occasion of the battle of La Vega, but there was then no danger of a Spanish defeat, nor did Columbus invoke the Trinity. Española was not miraculously given to Columbus on his first voyage, since it was only the fifth island to be discovered, nor did he invoke the Trinity in la Vega on that voyage. "Le miracle dont parle Colomb ne peut s'être produit que dans cette pré-découverte" (p. 21).

And many things become clear in the light of this pre-discovery. Columbus, when he had decided to apply to France and had come to La Rabida to fetch his son, was led to reveal the secret to Juan Perez, under the seal of the confessional. Perez at once hurried to Isabella, convinced her, and also Santangel and Coloma, of the justice of the claims of Columbus, and thus secured the support of the sovereigns for the expedition of 1492 (p. 13). Las Casas indicates his knowledge of the truth when he says that Columbus talked of the lands which he would discover as if he had them in a chamber of which he held the key; "qu'est-ce qu'on peut demander de plus à un prêtre, comme Las Casas, tenu à ne pas violer ce qu'il savait sans doute être le secret confessionel du Père Perez?" (p. 22). The truth was, however, effectually obscured by Ferdinand the Catholic, who, anxious to deprive Columbus and his heirs of their just reward, secured the wholesale destruction of authentic, and the wholesale fabrication of spurious, documents (pp. 4 *et seq.*). The chroniclers were in the royal pay and therefore supported the official view; Las Casas, who was honest, dared not publish his 'Historia de las Indias' (p. 7). In the sixteenth century, the dispute concerning the Columbian inheritance led to further destruction and further fabrication,

until at last it was possible for Lopez de Gomara to say with justice that no one knew when or by whom the New World had been discovered (pp. 2, 7).

At last, however, not only has the fact of the pre-discovery been established but its exact date has been ascertained. In a map of 1534, "Johannes Scolvus" is recorded as having visited Greenland in 1477, the very year in which Columbus voyaged to Iceland and a hundred leagues beyond—a distance which would bring him to Greenland. As it is impossible that two voyages should have been made to that land in one year, it is clear that "Johannes Scolvus" was really Columbus, Juan Colom (p. 22). But Columbus did not merely sail to Greenland. "Il a continué à Terre-Neuve, au Canada, en (*sic*) Florida, à Saint-Domingue ; mais il n'a pas voulu le dire" (p. 22), because he knew that were he to do so, Ferdinand would rob hin of the fruits of his achievement (p. 12). He probably landed in Española, but could not continue his discoveries, "n'ayant sans doute à sa disposition qu'une faible embarcation et ayant très peu de monde avec lui" (p. 18). He therefore returned to Europe, by way of the Canaries "vraisemblement," and reached Spain ; part of his crews had died on the voyage and the remainder were "sans doute des pauvres matelots, sans aucune connaissance scientifique," and were "incapables de comprendre l'importance de la découverte et d'en tirer profit" (p. 18). The legend of the pilot originated from the fact that either Columbus or one of his confidants let fall some hints of the truth ; the "pilot" was Columbus himself (p. 19). The cartographers converted Columbus into Colubus and thence into Scolvus (p. 22), and Columbus himself changed his baptismal name of Juan Bautista into Xristo-Ferens, which means the bearer of Christ in the moral sense, the precursor (p. 23). In the pages missing from *El Libro de las Profecias*, Columbus probably revealed his true name (p. 24). He called Cuba "Joana"; Ferdinand, in 1515, ordered that the island should be called "Fernandina"; "ce qu'il craint c'est que le nom *Joana* rappelle aussi le nom et la vraie origine de Colomb" (p. 27). In the same way, Ferdinand secured a change in the name of Porto Rico, and attempted to change that of Jamaica (pp. 28–29).

This thesis is, as Señor Ulloa very justly remarks, revolutionary, and the accuracy of the writer who puts it forward may therefore be legitimately subjected to the severest tests. Señor Ulloa is in error when he says that Bergenroth, having found the "texte authentique des Capitulations," "copia tout le texte, le traduit en anglais et le publia dans un de ses livres" (p. 9), as will be seen by a reference to the Calendar of State Papers . . . Spain (vol. I, p. 41, no. 70). The passage which Señor Ulloa renders, "j'ai trouvé ce que je cherchais," reads in the original, "dize qu'esta noche con el nombre de Nuestro Señor partiria á su viaje, sin más deternerse en cosa alguna, pues avía hallado lo que buscava, porque no quiere más enoho con aquel Martín Alonso" (*Journal*, January 9). It is not clear that Las Casas professed to be here giving the *ipsissima verba* of the Admiral; there is no indication that the decision to return had reference to a particular point having been reached, or that "lo que buscava" was Española rather than the Indies in general. The motive which led Columbus to leave Cuba appears clearly enough in the *Journal* ; it was disappointment that no large cities could be discovered. Señor Ulloa lays too much stress on the word "miraculously"; Columbus was always inclined to imagine a special dispensation of Providence on his behalf, and remarks that he was "miraculously" led to the service of Ferdinand and Isabella. The especial interest which he showed in Española is sufficiently explained by the fact that it was the only territory in the New World which he effectively acquired for the crown of Castille or for himself.

It is, however, in his treatment of the document which he describes as the

primary basis of his case that Señor Ulloa is most open to criticism. He gives (p. 8) what he describes as a "traduction littérale" of the opening passage in the *Capitulations;* the French is not a literal translation of the Spanish original, which is in the third person. While noting that "ha descubierto" appears only in the preamble of the document, he fails to add that in the body of the document the future tense is always used in reference to the discoveries. He hardly makes it clear that the document is not the actual agreement signed at Santa Fe, or that in that agreement the future tense alone is used.

It would seem, indeed, that Señor Ulloa has hardly appreciated the character of the document upon which he places so much reliance. In it, Columbus is consistently described as "D. Cristóbal Colon," whereas in the agreement of Santa Fé, he is merely "Cristobal Colón." The right to style himself "Don" was expressly conferred upon him after his return from the Indies in 1493. Vignaud's explanation of the appearance of "Don" in the *Capitulations* is that Columbus assumed the title without having been granted it. But that explanation cannot be accepted, since the document in the Archives of the Crown of Aragon is an original and not a copy, being, as Bergenroth noted, in the handwriting of Almazán, who was "very accurate." It is absurd to suggest that he should have casually conferred upon Columbus the title of "Don," which in the reign of Ferdinand and Isabella had a significance which it has not to-day. It was not a mere politeness, as was the Latin "nobilem virum," which appears in the passport granted to Columbus in 1492, but indicated that its holder had been ennobled. It follows that the document in question must have been drawn up after the grant of the title had been made, that is, after the return of Columbus. Its real nature thus becomes apparent. It was a draft prepared for the guidance of the sovereigns when they were intending at Barcelona to confirm the agreement made at Santa Fé, and it only appears in the Archives among the documents for 1492 because its contents refer to that year. Señor Ulloa is right in saying that "ha descubierto" is neither the error of a copyist nor a lie, and that it does represent a fact, but the fact is not that of a pre-discovery, but of the return of Columbus in 1493.

Space forbids any detailed examination of the remainder of Señor Ulloa's thesis. But it may be remarked that the identification of Columbus with Scolvus rests upon a number of hypotheses; that the identity of "Tile" with Iceland is assumed to be proved; that there is no shadow of evidence that "Scolvus" voyaged south from Greenland. The practicability of a voyage by ships of that period from Denmark, by way of Iceland and Greenland, down the American coast to Española is lightly assumed. The possibility of the mutation of the name of Columbus to Scolvus really depends upon acceptance of the Catalan origin of the Admiral. No evidence is brought to show that Columbus ever used the name "Xristo-Ferens" before his return from America in 1493. The charges of wholesale fabrication brought against Ferdinand and that of deliberate bad faith brought against the chronicles are unsupported by anything which can be regarded as proof, save by those who may be already convinced.

Among those who are so convinced, Señor Ulloa himself must certainly be included. His sincerity is obvious, although his judgment has been clouded by a preconception. His essay is delightfully written and may at least serve to afford a pleasant hour's reading to any one who enjoys ingenuity of argument in support of a wholly unsupportable thesis, or who cares to study the effect upon the mind of the domination of an *idée fixe*. C. J.

SEA-ICE

THE PROPERTIES OF SEA-ICE. By FINN MALMGREN. (The Norwegian North Polar Expedition with the *Maud*, 1918–1925. Scientific results, Vol. I, No. 5.) *Bergen: John Grieg, for the Geofysisk Institutt*, 1928. 12×9 *inches; 67 pages, and diagrams*

THE WIND-DRIFT OF THE ICE ON THE NORTH SIBERIAN SHELF. By H. U. SVERDRUP. (*Id.*, Vol. IV, No. 1.) 46 *pages; plates and diagrams*

THESE two memoirs have a particular appeal to the reader interested in polar science, appearing at a time when the leader of the expedition has, to all appearance, made the last great sacrifice, and one of his subordinates—the author of the first paper—has also lost his life in the recent Arctic tragedy. One aspect of Roald Amundsen's south polar venture which has been severely criticized was his failure to add to our exact knowledge of the new lands which he traversed for the first time. That this was not the normal attitude of mind of one of the greatest polar travellers the world has ever seen, these and their companion memoirs will bear strong witness. In truth, his southern journey was a magnificent non-scientific adventure undertaken to obtain the funds to carry out the more scientific survey of the north polar basin upon which Amundsen's mind had long been set. Its sketchiness can be defended on the grounds that, using the attainment of the South Pole as a means to a greater end, he concerned himself only with his main objective and refused to be distracted by, or to fritter away, his energies upon other aims.

The memoirs at present under review comprise only a small portion of the scientific results of the *Maud* Expedition, but they throw considerable light upon the scientific personnel and equipment of that expedition. A serious attempt has been made in the first towards a complete physical and chemical survey of ice-types of the polar basin met during a drift extending over several years, and the results have been carefully and exactly worked up and form a valuable contribution to polar science. Malmgren's work shows that polar exploration has lost a valuable observer, as the current accounts of his death agree in suggesting that in him we have also lost an intrepid traveller who had to a marked extent the temperament best suited to the peculiar character of the work of the scientist-explorer. Much of the work only confirms the conclusions reached by previous investigators, which were however based upon fewer and less exact observations. The draining of uplifted sea-ice until it becomes fresh enough to drink or use for cooking is again confirmed, reminding one of the fierce controversies upon the Stefansson Expedition, and of curious failures of notable explorers to appreciate a fact that has been a commonplace to generations of Arctic sealers and whalers and has been re-discovered again and again by explorers only to be again lost through lack of consistent record.

The application of modern physical and chemical apparatus and methods of research to the problem; the use of resistance thermometers and thermocouples for measuring sea-ice temperatures; the collection of thousands of exact determinations and their examination by graphical and mathematical methods; are all characteristic of the modern era of exploration and show how far we have travelled from the practices even of the early scientific expeditions of the twentieth century. The paper is probably the most complete and exact monograph to date on the physical characteristics of polar sea-ice, dealing at length with its salt content, specific gravity, specific heat, temperature, and thermal conductivity. It is therefore a contribution to polar science worthy of its author and of the expedition to which he belonged.

The second report deals with the wind drift of the ice over the North Siberian

Shelf, and thus with a subject of more direct importance to the traveller in Polar regions.

The ice-drift during the voyage of the *Fram* was found by Nansen to be due partly to a permanent current and partly to the winds, the action of which in the northern hemisphere is to cause a deviation to the right of the wind. Theoretically the amount of this deviation should be 45°, and should increase with depth owing to eddy viscosity in the sea-water; also the amount of deviation should be independent of the relative drift velocity, *i.e.* of the ratio current-velocity/wind-velocity. The observations of Sverdrup showed that there was no permanent drift in the area under consideration, and that the amount of deviation was, as in the drift of the *Fram*, less than the theoretical angle of 45°.

An interesting point which arose from grouping the observations according to wind direction is that the relative drift velocity and angle of deviation were greater for easterly and westerly winds than for northerly and southerly winds, a circumstance which is later shown to be due to a greater packing of the ice in the north-south direction due to tidal movements. In discussing the results of the *Fram* drift Nansen referred to the effect of resistance of other masses of ice as being of importance to the theory, but did not elaborate the reasoning. Sverdrup points to the existence of pressure ridges as evidence for the importance of ice friction; he also points out that the assumption of an eddy viscosity independent of depth of water is far from true in the area in question. So far from this being true, there is a pronounced stratification of the water at times, so that the whole of the surface water would slide over the lower layers almost without friction.

Starting from the assumption that eddy viscosity is a negligible factor, and that the chief resistance is due to that of ice against ice and is proportional to the velocity of drift, the author develops new formulæ. For the case where no accelerations occur he finds that the relative drift velocity is directly proportional to the coefficient of the wind effect and to the sine of the angle of deviation. The coefficient of the wind effect during the year has a variation similar to the increase of wind-velocity with height and the vertical temperature-gradient, and is regarded as a factor representing the efficiency of the grip of the wind upon the ice surface, and thus related to the turbulence in the air, since the wind-velocity is measured at some point above the ice surface. The chief maximum of turbulence is in April, with a minimum in January. As might be expected, the coefficient of ice resistance is found to have a pronounced annual variation, with a maximum when the ice is most closely packed and a minimum in summer. R. E. P.

REVIEWS

UNDISCOVERED FRANCE. By Émile F. Williams. *London: George G. Harrap & Co. Ltd.* 1928. 9×6 *inches;* 320 *pages;* 207 *illustrations.* 15*s*

This is a daring title in these days when a new book about travel in France appears every month; and the author must not flatter himself that he has "discovered" places like Bourges, Le Puy, and Albi. He describes a tour in South Central France from Angers to Toulouse and back to Bourges. The interest is very largely architectural and the illustrations are almost wholly concerned with buildings, though there are a few views in the valley of the Tarn and one, very striking, of the cliff overhanging Les Eyzies in Périgord, a place noted for its prehistoric remains. The architectural wealth of France is amply revealed; and photographs like those of the lovely sculptures at Moissac should certainly achieve the author's object of stimulating others to go and see what he has described. What is wanted is some means of restraining every one who goes from describing what he has seen. J. H. R.

MALTA AND CYPRUS. By G. Peto. (The Outward Bound Library. *London: J. M. Dent & Sons.* 7×5 *inches;* xiv+246 *pages.* 5*s*

This little book will appeal to those who are interested in the trivialities and domesticities of the life of an officer quartered in the islands of Malta and Cyprus. Incidentally some slight information regarding the country, climate, and products is introduced. The author evidently enjoyed her stay in the islands, and her lively style makes entertaining reading which is not lessened by her clever sketches. Within the covers are maps of Malta and Cyprus. The latter is inadequate, several places mentioned in the text not being indicated.

NEPAL. By Perceval Landon. 2 vols. *London: Constable & Co.* 1928. 10×7 *inches;* xxiii+358, vi+330 *pages; maps, plans, and illustrations.* £3 3*s net*

THE GURKHAS. By Major W. Brook Northey, M.C., and Captain C. J. Morris, with a Foreword by Brig.-General the Hon. C. G. Bruce. *London: John Lane* 1928. 9×6 *inches;* xxxi+282 *pages; map and illustrations.* 18*s net*

Landon's two volumes fall into four well-marked divisions. He describes for us the origins of Nepal; he treats of the inward and outward politics of the land from the time when it grew into a national entity; he gives us a finely drawn picture of three virile characters of the nineteenth and twentieth centuries whose doings, reacting the one on the other, have brought Nepal into the front rank of kingdoms; and finally, in a set of remarkably readable Appendices, he has examined every aspect of his subject, from Buddhism to ornithology, which falls outside the main narrative.

He is original in his treatment of the remoter period. He looks very hard at the farrago of "history" compounded by interested Hinduism, and refuses to be drawn into speculations on what the people may have been before the advent of Buddhism. Taking Asoka as his datum, he gives us an incontrovertible basis on which to build; and, in being forced to record the mixture of legend and pure invention which characterizes the Brahmanized "chronicles" of the Dark Ages, for many pages his pen runs haltingly and without conviction. Here is the only dull part of the book. From this point he goes on to trace for us a land sandwiched between the possibility of Chinese aggression through Tibet, and the greater probability of absorption by the growing power of the English. He here first brings out the fact that the rulers of Nepal succeeded, by sheer force of character alone, in keeping their country inviolate; an absorbing patriotism comes to the surface which is, thereafter, the keynote of the book.

It is not till 1766 that a real character emerges through the welter of com-

plications—Prithwi Narayan, whose depredations beyond his borders first brought Nepal into conflict with India, a conflict which broke into the open war of 1814–1816. Landon shows clearly the very narrow margin by which we were able to effect a settlement, and we get a picture of two angry dogs who have fought to a standstill and retire, licking their hurts, and silently determined to avoid quarrelling in future.

From this point Nepal goes ahead rapidly under a succession of strong men who, acting in the name of a shadowy king kept well in control, have consolidated the land, its people, and a national policy. They fall naturally into a trio. Bhim Sen, the keen-witted and far from scrupulous, who for thirty-three years, and against a background of palace intrigue in which the foullest means were attempted in order to keep the real power in the hands of the Brahman subterranean influences, worked with a single mind to the stabilization of dynasty and policy. The thanks he got was a hugger-mugger death in an underground cell, his last moments embittered by a concocted story of his wife's dishonour. Following him came the astonishing figure of Jang Bahadur, who, from a youth of brilliant vagabondage, emerges into the light as the leading figure of a palace dog-fight in which the principal characters were himself, a half-crazy Queen whose paramour had that day been slain, and a shrinking bevy of priests who looked to profit, whichever side came uppermost. In the striking and impartial picture which Landon draws of the Kot Massacre, he carries out his promise to us, in the Preface, of recording the most abominable happenings in Oriental high places with no further comment than that their ways are not our ways. But it is not till he commences to record the exploits of that Young Lochinvar, Jang Bahadur, that he throws off the veil of erudition and writes with a verve and a rhythm which convince us of his sheer love of his subject. The chapters run from his pen with a lilt and a laugh which are unmistakable; and a study of the portrait of Jang Bahadur on p. 136 serves only to give further point to the personality of a man who might have conquered a kingdom, ruled an empire, and then have given away his ultimate farthing to the last surviving man of the many who planned to murder him. The chapters dealing with his doings are a masterpiece of description. The imbecile plots of the King in the background; the furies of the frantic and sex-demented Queen screaming encouragement to the slayers from an upper window; and the light-hearted debonair soldier and sportsman whose every action was crowned with a success which fate never denies to the morally and physically fearless—the whole story rings as true as the clink of a gold coin. Never has Landon written better, or painted a more vivid picture.

Jang Bahadur's was a life packed with activity of brain and body; and perhaps the most unusual reward that fate provided for him was the fact that he, the only one of the strong men of Nepal, died a natural death.

The third personality is one whom Landon, perhaps rightly, thinks the most capable of the trio—Chandra Shamsher. Where Bhim Sen was the embodiment of sheer driving power, and Jang Bahadur virile chivalry, Chandra Shamsher is all brain. To him has fallen the difficult task of bringing into line with modernism a land which has only recently emerged from the Middle Ages, with the result that Nepal is now more than ever an entity to be reckoned with. His help to our cause during the War is too well known to need re-emphasis. Clearly, it was due from the first to the manliness of a race which simply could not sit still while others were up and doing.

Landon's twenty-five Appendices are admirable; each would expand to a book in itself; while to speak of the adequacy and merit of illustrations, maps, and index is superfluous when describing what will be the leading reference-work on Nepal for the next fifty years.

Major Brook Northey and Captain Morris have obviously approached their subject in the spirit that "we have had to be content with Vansittart for a generation. Let us now produce something better"; and right well have they done it. Read twice, the second reading modifies the first impression that it does not rise above the level of good, sound gazetteering, though the amount of space given to tribal ritual observances is regrettable. This is especially the case with regard to the Newars, who occupy that extraordinary meeting-place between Buddhism and Hinduism where the two religions run hand-in-hand without clashing—a vital aspect which has been obscured by over-description of their caste and customs. For the rest, the book touches on no subject which has not been more fully dealt with by Landon. The index, unfortunately, gives that staccato effect produced by a small boy rattling a stick along railings. The authors do not realize that the art of index-making lies in using a geographical name as the setting for the doings of its inhabitants, and the name of a man as marking the events in the history which he made.

The illustrations and map are excellent; and the whole is a conscientious piece of work, the result of much labour. L. A. B.

THE LAND PIRATES OF INDIA. By W. J. HATCH. *London: Seeley, Service & Co. Ltd.* 1928. 9×6 *inches; 272 pages; map and illustrations.* 21*s*

The Kuravers of this book are the Kuravans of the Imperial Gazetteer of India, where they are described as a foreign race whose manners and customs have much in common with those of the wandering tribes known in England as gipsies—a description apparently taken from the Abbé Dubois's book on the manners and customs of the Hindus. The index to Risley's 'The People of India,' under *Kuravans*, describes them as "gipsy-like nomads," and merely gives a reference to a proverb, quoted also in this book—"Have you ever seen a dead monkey or a dead Kuravan?"

The author does not explain why he prefers the name Kuraver, nor is his account of their origin in chapter ii at all conclusive. Whether they are of the same race as the English gipsies or not they are extraordinarily like them in their manner of life; both are fortune-tellers, basket-makers, and depredators of live stock; and the catching title, 'The Land Pirates of India,' is not more justified than 'The Land Pirates of England' would be as the title of a book on the English gipsies. The ruthless and bloodthirsty violence associated with piracy is in no way characteristic of the Kuravers, whose pride is in the skill and cunning with which they carry out their malpractices, and the skill and cunning with which they evade the law. Major Bevan in the reminiscences of his life in India, published in 1839, describes the ingenuity with which the members of a predatory tribe could abstract the sheet from beneath a sleeping man without disturbing him, an accomplishment ascribed to the Kuravers in the book under review. It is such clever cunning as this that is the ideal of Kuraver practice.

The author has obviously had excellent opportunities of studying the idiosyncrasies of one of the most interesting of Indian castes, but what he has to say that is of value could have been comprised within the limits of a much smaller volume. He repeats himself, and his style is diffuse and often inconsequent. The illustrations are excellent. W. H. A. W.

THE ITINERARY OF LUDOVICO DI VARTHEMA OF BOLOGNA from 1502 to 1508, as Translated from the Original Italian Edition of 1510 by John Winter Jones, F.S.A., in 1863, for the Hakluyt Society, with a Discourse on Varthema and his Travels in Southern Asia by Sir R. C. TEMPLE,

Bt., C.B., C.I.E. *London: The Argonaut Press* 1928. 10 × 7½ *inches;* lxxxv + 121 *pages; five maps and two illustrations.* 25*s net*

Two translations of Varthema's travels have hitherto appeared in English. The first, published in 1577 by Richard Eden in his 'Collection of Voyages and Travels,' was made from the Latin version of Madrignano of 1511, not always accurate in itself, and is very defective. The second is a careful translation of the original Italian edition of 1510 made in 1863 by J. Winter Jones, which was edited, with valuable notes, by G. P. Badger and published as No. 32 of the First Series of the Hakluyt Society's publications. The present edition is a reprint of this latter translation, with a very full preliminary Discourse by Sir R. C. Temple, whose personal acquaintance with so many of the lands visited by the traveller makes it the more interesting.

Up to date nothing definite is known of Varthema's life beyond what he himself has told us and what we find in the works of the Portuguese historians, Castanheda, de Barros, Goes and others, which, so far as they go, corroborate his own account of his activities on the Malabar coast; and this information is confined to the period of his travels (1502–08) and possibly a year or two on either side of this. We do not even know the year or place of his birth or death. To judge from the many (some thirteen) editions of his book printed within ten years of its first appearance in Italy, Germany, and Spain, Varthema's account of his travels appears to have been favourably received in the first instance, but later on he seems, like so many other pioneer travellers, to have become widely discredited. The adverse comments of Garcia da Orta in his 'Coloquios' (first published in 1563) were perhaps largely responsible for this. In his 'Discourse' Sir Richard Temple deals at length with this question of Varthema's credibility, and comes to the conclusion that he was truthful, yet capable of making mistakes. He has done an important service by his detailed examination of the traveller's movements from place to place, indicating how they may be explained on the assumption that Varthema actually travelled as related, and suggesting approximately the dates of the itinerary. There are many details in the story that stamp it as based upon personal local observation. On the other hand there are still many points to be further cleared up, *e.g.* the question of the journey to Herat, the identity of the "city of Banghella," and of the islands visited in the Malay Archipelago—Bandan, Monoch, Bornei, and Giava. A suggestion is put forward that by Eri Varthema refers to Herat-i-Khara, to the east of Lake Niriz, but the text as we have it clearly refers to the capital of Khurasan under the Timurides. By the "city of Banghella" is evidently meant the port of the country then known as Bengala, just as a port on the Coromandel coast (? Negapatam) is described as "a city which is called Cioromandel." Barbosa, about a decade later, also writes of "a great city of the Moors, which they call Bengala," which he described as lying to the north of the Gulf of Bengal "going well into it." Sir Richard takes this place, for the purpose of defining Varthema's journey, to be Satgaon, the old port on the western outlet of the Ganges. He rightly rejects the identification with Gaur, which can be shown to be impossible. Yule at one time seems to have thought it might be Sunargaon, but ultimately decided that the port of Chittagong was intended. As regards the eastern archipelago, Varthema's descriptions of the islands named, their sizes, and the distances travelled, have yet to be reconciled with the geographical facts. It is possible, perhaps, that this part of the story, as it has come down to us, is not all in due chronological sequence.

This edition has been admirably printed on Japon vellum. Looking at the sketch-maps, Akabat-ash-Shami has been slightly misplaced; and Kayal, the Colchi of the Periplus and Cail of Marco Polo, lay near the mouth of the

Tamraparni river in the modern Tinnevelly district. By Giulfar, Varthema seems to have meant a port, spelt Julfar in old accounts and maps, that lay inside the Persian Gulf, south-west of Ras Masandam, and not Dhofar on the south-eastern coast of Arabia, as shown on a sketch-map. C. E. A. W. O.

ANGOLA SKETCHES. By T. ALEXANDER BARNS. *London: Methuen & Co.* 1928. 9×6 *inches;* viii+205 *pages; maps and illustrations.* 12*s* 6*d*

In 'Angola Sketches' Mr. Barns, naturalist and traveller, relates entertainingly his journey across Angola with "Ernest"—a second-hand Ford car. Besides a description of the country he has seen, he gives a short, but accurate, account of Angola's history, its political and economical conditions, and calls attention to the great possibilities it offers for future development. A book of this kind has been long needed. The literature dealing with the oldest West-Central African colony has known curious ups and downs. Shortly after its discovery by the Portuguese and for the next century and half, Angola was the subject of a good number of books, written by keen observers. The most valuable of these, Cavazzi's 'Istorica descrizzione degli tre regni Congo, Angola e Matamba,' has never been translated into English; perhaps the Hakluyt Society may one day see its way to giving us such a translation; if carefully annotated, it would be a priceless boon to students of Africa. After this period interest flagged, or, more probably, the quality of men sent out deteriorated; not till 1875 do we get another serious book, the 'Angola' of Monteiro, who, notwithstanding his name, was an Englishman. About this time the Germans sent out several semi-scientific, semi-political expeditions, and these resulted in some valuable papers by Pogge, Wissmann, Schütt, von Mechow, Büchner, and others. The Portuguese, however, with the exception of C. Carvalho's Lunda Expedition, did little to increase our knowledge; the honours bestowed on Serpa Pinto were more due to his achievement of crossing Africa than to the scientific results of his expedition, which have scarcely stood the test of time.

The real heroes of this period were mostly men who did not, and probably could not, leave written records of their deeds, such as Silva Porto whose explorations extended even farther than Mr. Barns gives him credit for: he penetrated as far north-east as the Lulua and the lower Sankuru. He was a slave trader, but of a different kind from the notorious Coimbra, described by Cameron. If there had been more men of Silva Porto's stamp and fewer of Coimbra's and Alvez's, Angola would not have been outclassed by the neighbouring colonies on which she had a start of nearly four hundred years. It was unfortunate that the better elements as a rule remained near the coast and that the interior was left to the tender mercies of the slave traders, the bane of the country. This trade survived for many years its official obituary notice; as recently as in 1907 the reviewer has still seen raiders at work. However, Mr. Barns assures us that Angola has now been roused from her long sleep and is progressing with giant strides. The traffic in slaves has been killed, and people have been forced by circumstances to exploit her hidden wealth which for centuries they had neglected. The highlands are healthy and suitable for white settlement: the condition of the Portuguese and German farmers can leave little doubt on the subject. The Portuguese Government has at last realized the disadvantages of its policy of excluding foreign enterprise.*

One or two slips in the book might be corrected in future editions. The title of the ancient king of Kongo was Ntotila: Mani, used by Mr. Barns, is that of

*It will be remembered that an equally sanguine view of the future of Angola was taken by Col. Statham in his book 'Through Angola' (1922), one of the best previous accounts of this country.—ED. *G.J.*

feudatory princes. The Bachokwe, Wachokwe, and Bushokwa are identical with the Kioko, not separate peoples. It is surely by a slip of the pen that the Benguella plateau is referred to as "one of the last well-watered regions in a continent" where the desert is encroaching everywhere! The interesting plate facing p. 70 does not depict a "god"; such clay figures, *mbuyu manga*, representing various animals (the leopard is the most common) are simply what, for lack of a better word, one generally calls "fetishes."

'Angola Sketches' will be of great value to those who intend visiting Angola, for sport, business, or with the intention of taking up farming in a new country. It will be quite as acceptable to those who prefer, or are restricted to, travelling in an armchair by the fireside. E. TORDAY.

LA DÉCOUVERTE DE L'AFRIQUE AU MOYEN ÂGE. Cartographes et Explorateurs. By CHARLES DE LA RONCIÈRE. Tome III. Un explorateur français du Niger. Les debuts de Christophe Colomb. Un peintre italien à la Cour d'Abyssinie. (Mémoires de la Société Royale de Géographie d'Egypte, T. 13.) *Cairo* 1927. 14×11 *inches;* viii+130 *pages; plates*

The third and concluding volume of the work on mediæval Africa undertaken by M. de la Roncière under the patronage of King Fuad of Egypt is somewhat slimmer than those preceding it, though its contents offer perhaps more of novelty. The three reproductions of fifteenth-century maps do not play so important a part in contributing to the book's attractiveness as did the beautiful plates of the earlier volumes, but they are more directly illustrative of the text. The author tells no continuous or connected story, but gives us instead a miscellany of short articles some of which are little concerned with Africa, though all are of interest for the history of discovery.

The first and earliest in point of time recovers for us at second hand the story of a Frenchman from Toulouse who was resident at Gao on the Niger in the fourteenth century, and, having married a daughter of one of the reigning chiefs there, returned to his native city to found a family that lost nothing of respect because of the admixture of negro blood in its ancestry. Our knowledge of the story is dependent upon extracts from a contemporary chronicle and the little-known work of an antiquary of the time of Louis XIV, which are here reprinted. They are tantalizingly scanty, and especially so in that they contain a description of what was probably the earliest dictionary of an African language. This was extant at the end of the seventeenth century, but M. de la Roncière has not succeeded in tracing its present whereabouts if it still exists. It is much to be hoped that he will be successful in a further search, for its recovery could not fail to be of first-rate interest to philologists.

A second article definitely identifies the Genoese trader Malfante, the story of whose residence in the Sahara oases in the fifteenth century was dealt with in an earlier volume. Malfante's connection with the trans-Saharan trade in gold-dust leads on to a consideration of the activities of his employers, the Genoese firm of Centurione, in the international money market of the fifteenth century. One of the family was member of a committee inquiring for the Bank of St. George into measures for monetary stabilization after the devastation of the Hundred Years' War, and it is claimed that he was the originator of the idea of a gold standard. The firm was continually on the look-out for new sources of supply, and their knowledge of the African gold trade had some share in influencing the schemes of Prince Henry and the Portuguese.

The book would be of very great interest even for this suggestive line of inquiry alone, but it carries us further. It is known that Christopher Columbus was employed by the Centurione as a commercial traveller, and it was in their

service that he travelled to the Levant to purchase wine and mohair, and later to Madeira for sugar. The speculation was not profitable, and we have here printed in full from the Genoese archives the legal depositions concerning it that were made after Christopher's return. The author suggests that it was in his service for the firm that he first became interested in the search for gold supplies, and that this became the predominant motive in all his later proceedings. M. de la Roncière goes further in crediting the stories of Columbus' voyage to England and to Thule than many would care to follow him, but his suggestions are very interesting to all who have followed the Columbian controversy and are familiar with the work of Vignaud. They form the bulk of the book and lead us through fresh suggestions concerning the Toscanelli letter and Columbus' cartographical work to a study of his geographical ideas and to further contributions to the controversy over the unique map from the Bibliothèque Nationale that M. de la Roncière published a year or two ago and is here reproduced. The conclusions reached will hardly command universal assent, but it cannot be claimed that the last word has yet been said on the matter.

To the remaining articles and the documents attached we can make only a brief reference. Further light is thrown on the supposed cure for leprosy that Louis XI wished to obtain from the "Isle Vert," probably one of the Cape Verde islands, and upon early visitors to Abyssinia in the fifteenth century. The last contribution deals with a painter at the Abyssinian Court two centuries later to whom certain of the church decorations in the country of Prester John are due. The volume concludes with a general index to the whole work. A. P. N.

A HISTORY OF MONTREAL 1640–1672 from the French of DOLLIER DE CASSON, translated and edited by RALPH FLENLEY. *London and Toronto: J. M. Dent & Sons, Ltd.* 1928. 9×6 *inches;* xii+384 *pages; map and plans.* 25*s*

Professor Flenley of the University of Toronto deserves much credit for this scholarly edition of Dollier de Casson's 'Histoire du Montreal.' The translation is most readable and the notes full of interest. Thanks to the kindness of Mr. Ægidius Fauteux, the learned Librarian of the Bibliothèque Saint-Sulpice at Montreal, the editor has had access to the Tronson correspondence there, which throws new light on many of the people and incidents mentioned in this narrative. We should have welcomed a fuller account of Casson's Voyages to Lakes Erie and Huron in 1668–69 with Galinée and La Salle, as well as that with Courcelle to Lake Ontario in 1671, but it is only of his voyage to relieve the scurvy-stricken garrison at Fort St. Anne on Lake Champlain in the winter of 1666 that we have any complete account.

Casson, who had been a cavalry officer, lived in troublous times, and his narrative has lost nothing in the telling. The daring exploit of Dollard des Ormeaux at the Long Sault is well known, but many of the other fights with the Iroquois are only narrated here. The terror imposed by these devils was such that each man's cabin really became a fortress. Hair-breadth escapes were matters of everyday occurrence and show the wonderful spirit of the inhabitants. Casson has not much to say of the fur trade nor of the economic development of the country, but he gives us a picture of the great annual barter at Montreal, which though picturesque has also its unedifying side, due to the drunkenness of the Indians. On the whole we get a striking picture of early life in French Canada, and great credit is due to Professor Wrong for urging upon Professor Flenley the publication of this volume.

While La Potherie is usually thus referred to, in the Introduction by some oversight the map from his book is attributed to Claude Charles "Lepoy." Even if his surname was Le Roy he is nearly always referred to as La Potherie. There is a good index and the volume is well printed. H. P. B.

A JOURNEY ACROSS THE ISLAND OF NEWFOUNDLAND IN 1822. By W. E. CORMACK; edited by F. A. BRUTON. *London: Longmans, Green Ltd.* 1928. 7×5 *inches;* xviii+138 *pages; map.* 1*s* 6*d*

This edition of Cormack's narrative of his journey, with brief biography and most interesting notes, has been specially prepared at the request of the Dominion Educational Authorities for use in their schools; it may also be strongly commended to all who are interested in the history of our first colony, "the ship from which men fish." Cormack, friend of Jameson, Hooker, and Faraday, was, as Perret points out, a truly scientific traveller, and in this little work the scientific observations made by him on his journey are well dealt with.

The journey itself is of interest as apparently the first of which record is preserved in which the island was crossed from coast to coast. This fact was disputed by Lord Bathurst, but the grounds on which his statement was based are not known to the reviewer, nor is the editor of the present reprint able to solve the question.

On p. 116 the author would have done well to state that it was John Cabot, not his son, who landed in Newfoundland in 1497; and it may be mentioned (p. 126) that of the two species of "grouse" in Newfoundland, the Willow or Allan's ptarmigan, and the Rock or Welch's ptarmigan, the latter is quite distinct from the *Lagopus* of any other country. On this matter Newfoundland writers are generally incorrect. To study Dr. Bruton's work has given the reviewer real pleasure. G. D. McG.

THE PEOPLE OF THE TWILIGHT. By DIAMOND JENNESS. With Drawings by CLAUDE JOHNSON. *New York: The Macmillan Company* 1928. 9×6 *inches;* xii+248 *pages; illustrations and sketch-map.* 12*s* 6*d*

Diamond Jenness, who took part in "The Canadian Arctic Expedition, 1913–18" as ethnographer, has long since established his name as a man thoroughly familiar with the most isolated of Arctic Eskimo tribes in Canada by his scientific descriptions of the intellectual and material culture of the Copper Eskimos. The material which he collected about the headquarters of the expedition at Bernard Harbour in the years 1914 to 1916 has enabled him to write a number of standard works which will remain as models of how a man of science ought to depict a primitive people, its land, and the conditions under which it struggles for existence.

After having dealt with the great body of scientific material, Dr. Jenness has now published a book in more popular vein about these same people, and in it this outstanding scientist reveals himself as an equally outstanding writer and stylist who knows the art of making even the strangest conditions appear vividly to others. He has lived the Eskimos' own life, having allowed himself to be admitted into an Eskimo family as its adopted son. He cut himself off from all the conveniences of headquarters: warmth, comfort, and white man's food, and, with no other supplies than those which are peculiar to the Eskimos, he shared with them their nomad life and all the vicissitudes of their existence, winter and spring seal-hunting out on the sea ice, even making himself one of the people of the snow-houses in all weathers; summer and autumn continuously wandering in distant Victoria Land, fishing for trout and salmon on the lakes of the interior, or hunting the roving game with the men of the tribe. On the background of a life on the closest terms with his adopted father Ikpakhuak and his wife Higilak and their nearest kinsfolk, he now depicts the life of the Eskimo on the desolate shores of the Arctic Ocean, and, interspersed in all the exciting adventures of hunting life, at times famished, at others with more than abundance, he initiates us into the habits and customs of the tribe, its religion, its

legends, and its songs. His manner of recounting is collected and elegant, like the man himself, and by enchanting descriptions of nature and animal life he conjures up days and nights, not merely in the gloomy and stern atmosphere of cold and darkness and blizzards, but also in the delightful charm of the midnight sun and the beautiful Arctic summer. Although the savage customs of the people often involve him in difficulties which would be dangerous to the traveller who did not know how to deal with primitive minds, his narrative never strives for effect, but in all his observations, some of which disclose fine, others less creditable, qualities in the natives, his sole aim is to penetrate into that profound human quality that is common to us all. He establishes facts as they are, often with an excuse, never with condemnation. For these reasons this book bears a message to all who take an interest in human life; and the composure, the sense of justice and love which the lines everywhere reflect, make it one of the most truthful and most beautiful books ever written on a primitive people. For its author has proceeded to his task without bias, without the superiority of the white man. And no one reading it will be able to lay it down without a feeling of sadness that the forceful, peculiar, and variegated life which imparts colour and strength to the book will soon be but a memory, even in these remote and desolate wastes. For all-conquering civilization knows nothing of distance, and before long all children of nature will be so levelled that we shall all be one. But just for that reason a book like this has not been written in vain.

KNUD RASMUSSEN.

GEOGRAPHY OF NORTH AMERICA. By G. J. MILLER and A. E. PARKINS. *New York: John Wiley & Sons; London: Chapman & Hall* 1928. 9×6 *inches;* xvi+606 *pages; illustrations, diagrams, and maps.* 22*s* 6*d*

Any treatise on the geography of North America which devotes proper attention to economic geography is bound to allot a preponderating share of its space to the United States; and though the writers of this book have given two-thirds of the text to the treatment of their own country, one feels on reading through the work that they have maintained throughout a due sense of the relative importance of both of the different political subdivisions, and of the various topics selected.

The plan adopted consists of a combination of the regional and economic methods. In the first chapters the continent is reviewed as a whole under the headings of habitability, climate, and economic development. In the succeeding twenty-seven chapters four broad natural regions in the United States, four in Canada, and one for each of the areas Alaska, Mexico, and Central America are recognized and treated in greater or smaller detail according to their economic importance. Thus Canada and Newfoundland get five chapters, the North-Eastern group of States four chapters, Mexico two, and Central America one. The method of reserving separate chapters for such outstanding topics as the fishing industry in the North-Eastern States, agriculture in the South, and mining in the West, has much to recommend it; flexibility in arrangement, on the other hand, is secured by dealing with less important regions, such as those of Canada, completely in single chapters, and by selecting typical districts for detailed account of economic activity within the major area over which great industries are widespread.

With certain reservations this Geography of North America justifies the aims set out by the authors in their preface. It supplies abundant information, it contains much reasoning from cause to effect and from effect back to cause, and it illustrates various serviceable methods of organizing geographical material as weapons of critical analysis. It is natural and proper that the main objective in every section should be a reasoned account of the manner in which human

endeavour has been directed to the establishment of this or that industry according to the nature of the environment. Insensibly, therefore, the authors are led to include some reference to historical phases in economic development. They are indeed to be envied in their task of tracing the triumphant progress of material achievement in a continent where nature has been so generous with her gifts.

A tendency, however, is apparent in the authors, in common with some others, in writing of the country and the continent in which they live, to find it difficult, in spite of manifest effort to the contrary, to take a detached view. They accept too readily the dollar value as a scale of measurement, when estimates framed on a quantity basis would give a much truer picture, especially in comparing one period with another. They are apt to retail masses of figures, taken from Census Reports, without selective or reasoning purpose, owing, it would appear, to a kind of mechanical habit. Their sense of scientific comparison is sometimes weak and leads now and then to the adoption of a superficial outlook towards geographical material.

The text is amplified by means of 296 illustrations, comprising numerous more or less simple statistical diagrams, and in addition plenty of well-chosen photographs and a selection of carefully executed and sometimes quite elaborate maps. The illustrative material, in fact, is both lavish in quantity and suited to the text, which is itself agreeably set out and printed. Altogether, this work will prove a reasonably comprehensive and more or less stimulating study of North American geography, useful alike to serious students and to others who may be brought by their dealings into contact with what is at present the most rapidly developing of all the continents. E. W. S.

THE VOYAGES OF JACQUES CARTIER. By H. P. BIGGAR, D.LITT. (Publications of the Public Archives of Canada, No. 11.) *Ottawa: By Authority of the Secretary of State* 1924. 10×7 *inches;* xiv+330 *pages; maps and illustrations*

This volume represents the worthy fruits of long study in the field of Jacques Cartier's explorations. Dr. Biggar has searched the whole wide range of literature on the subject, and one feels that he has provided an original text and translation which will be regarded as authoritative for a long time to come. The work includes complete reprints, new translations, and excellent annotations of all known original narratives of the Cartier voyages of 1534, 1535–6, and 1541, along with Roberval's voyage of 1542. The corresponding material of text, translation, and notes are conveniently presented on the same page. There are, besides, illustrative maps and pictures, together with seven appendices of varying importance.

Dr. Biggar has wisely allowed the narratives to speak for themselves, and has made no examination of Cartier's life, even in relation to the circumstances of his voyages. His book is Cartier's own journal. The explorer sets down in almost diary form the experiences of a sailor who leaves a quiet haven at St. Malo in a tiny cockleshell of a boat to penetrate the mysteries and silences of a world unknown. "On Sunday May 16, the day and feast of Whitsuntide, in the year 1535," reads the journal of the second voyage, "by the command of the Captain and the willing consent of all, each confessed himself and we all received our Creator together in the Cathedral of St. Malo. . . . And on the Wednesday following, May 19, the wind came fair and in our favour and we set sail."

None of these voyages holds the fascination of absolute uncertainty, such as belongs to those of Columbus or even Magellan. The dark curtain which Leif Erickson had for a moment lifted from the New World, had now been fairly

drawn. Furthermore, Cartier had little of the romantic zeal which we find in Columbus or the crusading fire of a Cortez fighting his way to the Pacific. Like the soldier Champlain, however, we can see even the stolid Breton sailor expand to the majesty of a scene, which slowly unfolded before him as he traced the St. Lawrence to Hochelaga and the Lachine Rapids. On reaching the summit of Mount Royal, a quarter of a league from Hochelaga (Montreal) he relates, "We had a view of the land for more than thirty leagues round about. Towards the north there is a range of mountains running east and west (the Laurentian hills) and another range to the south (the Adirondacks and Green Mountains of Vermont). Between these ranges lies the finest land it is possible to see, being arable, level and flat. And in the midst of this flat region one saw the River (St. Lawrence) extending beyond the spot where we had left our long boats. . . . And as far as the eye can reach one sees that river large, wide and broad, which came from the southwest. . . ." The traveller of to-day who has climbed Mount Royal will appreciate Cartier's reaction to the glory of that panorama.

We have little definite knowledge of the friendly Indians whom Cartier met on his St. Lawrence expeditions. Occasionally he speaks of the affectionate ardour of their welcome and of the strength and efficiency of their little villages. In most cases these were circular in form and completely enclosed by wooden pallisades in three tiers like a pyramid. The top one was built crosswise, the middle one perpendicular, and the lowest of strips of wood placed lengthwise, the whole being well lashed together and "some two lances in height." When Champlain followed Cartier sixty-eight years later, he found these fortified towns had gone, along with their builders. The strange history of the exodus of these village Indians had little interest for the French adventurers, and an easy field of research for that day was neglected. We do know, however, that they were of Huron-Iroquois stock, and not Algonkins.

Dr. Biggar has been subjected to some criticism on account of his frontispiece, a coloured engraving of a full-length figure from M. de Clugny's 'Costumes françaises depuis Clovis jusqu'à nos jours,' purporting to be Jacques Cartier. Unfortunately, as the author has himself since admitted, we have no definitely authoritative portrait of Cartier.

In some cases dissent is possible from the author's geographical identifications. But where finality is impossible doubts are hardly blemishes in a work so obviously the performance of a true scholar. G. S. G.

PICTURE WRITING AND OTHER DOCUMENTS. By NÈLE, Paramount Chief of the Cuna Indians, and RUBEN PEREZ KANTULE. Published by Erland Nordenskiöld. (Comparative Ethnographical Studies, 7, i.) *Göteborg: Elanders Boktryckeri. Oxford: University Press* 1928. 9×6 *inches; 94 pages; and illustrations. 5s*

This monograph is the result of a journey to Panama and Colombia in 1927. The particular interest of this study is the discovery that Picture Writing is still known and practised by the Cuna Indians, who live in villages on the Atlantic coast of the Isthmus of Panama. Néle, the paramount chief of the Cunas, a very intelligent man, is well versed in the history of his people. He has as his secretary a youth, Ruben Pérez, who has been educated at a school in Panama, and so knows Spanish well: he has also learnt the Picture Writing from a medicine man of the tribe. The Picture Writing is now understood only by the medicine men, who use it to record songs and incantations.

Two examples are given. They were dictated by Néle in the Cuna language to his secretary, who has transcribed them with an interlinear translation in Spanish. Pérez has also supplied the equivalent Picture Writing. The latter is

put out in five plates, and by means of figures a close comparison of the picture signs and the Spanish text can be made. The first example is entitled *Nacbe ina*, which means Snake Medicine. It describes a case of illness and the proper remedies to be used. The second, entitled *Acualel*, meaning sacred stone, is an incantation showing how the medicine man restores to its body a soul that has been carried away by evil spirits. The picture signs are various, human, animal, and plant forms, and circles, being very characteristic. Several colours are used: black, red, green, blue, and yellow. In the *Nacbe ina* plant forms very largely predominate. The Cunas believe that all plants are medicinal, and attach a magical significance to their colours especially when used as protective medicines.

The Cunas are the only people in Central America who now practise picture writing. According to Néle it was invented 800 years ago by their culture hero Ibéorgun. That it is of considerable antiquity, and was in use before the arrival of Europeans is shown by the fact that wood was the original material used for the writing, that neither Latin characters nor the Christian cross are found among the signs, and that it is read from right to left. Further, the magical character of the writing points to Indian origin. Whilst it has no resemblance to Maya writing, it recalls somewhat the Picture Writing of Ancient Mexico, and Baron Nordenskiöld is inclined to the opinion that it is possibly a degenerate form of it. This is suggested by the knowledge that the Indians of Darien at the beginning of the sixteenth century were in contact with Indians from Nicaragua, who possessed some kind of picture writing. Further specimens of this interesting script are promised in a second part. E. A. P.

ODDITIES: a book of unexplained facts. By Lieut.-Com. R. T. GOULD, R.N. *London: P. Allan & Co.* 1928. 9×6 *inches;* 336 *pages; illustrations and maps.* 12*s* 6*d net*

Among the mysteries which Com. Gould has collected and in some cases tried to explain there are two which have geographical interest: the fate of Franklin's ships and the lost islands of the Southern Ocean. The nine other chapters are, strictly speaking, outside geographical interests, but they are equally fascinating and lose nothing by the author's telling. No tale of adventure or even a well-constructed detective story could hold the reader's attention more closely. The fate of Franklin's ships was never solved. Eskimo reports which McClintock collected spoke of the vessels foundering in the vicinity of King William Island, one being forced ashore and one going down in deep water. With that the mystery might be solved had not two vessels been sighted on an ice floe off the Newfoundland Banks in 1851. The vessels were not visited. Were they Franklin's ships? It is not impossible. Comr. Gould argues the problem in detail and inclines to the belief that they were the *Erebus* and *Terror*, though we find it hard to accept that view. Another problem is that of Thompson Island, which Norris in 1825 reported to lie north-east of Bouvet Island. It has been searched for but never found again, unless Fuller sighted it in 1893. By plotting the tracks of search vessels and their range of visibility Com. Gould shows that a considerable area of sea centring about lat. 54° S. long., 4° 35′ E. has not been searched. There he believes that Thompson Island will be found.

R. N. R. B.

CHRISTOPHER CODRINGTON, 1668–1710. By VINCENT T. HARLOW *Oxford: Clarendon Press* 1928. 9×6 *inches;* viii+252 *pages; portraits and map.* 12*s* 6*d*

This book relates the life of a West Indian planter, soldier, and administrator, who was born at Barbados, was educated at Oxford and the Middle Temple, served with distinction in William III's Flanders wars, and returned to govern

the Leeward Islands just as the Spanish Succession War was on the point of breaking out. His story is worth reading for the character and adventures of the man himself, for the light it casts on the working of the old colonial system, and for the manner in which Mr. Harlow has written it. On the latter point it may be said that there is not a dull page, that the English is terse and pruned, and that the author secures vivid effects in his narrative by knowledge and choice of details gathered from contemporary sources.

West Indian society in the first century of English colonization is revealed in a light that is not pleasing, but the picture is confirmed by other studies of the period. Economic motives were the springs of political action, and envy and malice were quick to manifest themselves when on rare occasions a public-spirited man took command. Codrington was such a man, as his father had been before him, and both were harried unceasingly by the mean little scoundrels whose malpractices they stopped. Mr. Harlow attaches considerable importance to the personal element in the failure of the old colonial system, a matter that is apt to be obscured in more purely institutional treatment of the subject. A root cause of the breakdown, he says, was that important posts were commonly filled not by good administrators but by place-hunters. Codrington spent money out of pocket because his salary was insufficient. The lower type of official was determined to make money: "The result was almost inevitable. In nine cases out of ten they supplemented their deficient incomes with substantial bribes and winked at the violation of those laws [of Trade and Navigation], or, worse still, engaged in the illegal trade themselves."

Colonial administration fills only part of this book. Oxford in 1685–94, and London literary life in the same period, and then the scene shifts to Flanders and the siege of Namur, where in two campaigns Codrington rose to the command of a battalion under the eye of so exacting a general as William III. In the governor-generalship of the Leeward Islands there was more soldiering. At St. Christopher Codrington succeeded and drove out the French, for ever, as it proved. At Guadeloupe he failed through no fault of his own after an initial success. Tropical campaigning and the medicine of the period virtually killed him. He took laudanum to cure dysentery, and overdid it, so that he was blind and paralyzed for many weeks. He partially recovered, but as a broken man, with spirits depressed by the malignant attacks made upon him by the enemies of pure administration. A few years later he died at the age of forty-two, having sounded, within his limited scale, all the depths and shoals of honour.

J. A. W.

VENTURES AND VOYAGES. By E. KEBLE CHATTERTON. *London: Longmans, Green & Co.* 1928. 9×6 *inches; 218 pages; and illustrations.* 10*s* 6*d net*

All who are interested in adventure on the seas will welcome this latest book of Mr. Keble Chatterton. There is nothing new in it, but every story bears retelling. They are collected from various sources and range from the age of discoverers to recent days, and touch all oceans. Among the best-known stories are the wreck of the East Indiaman *Grosvenor*, the voyage of John Hewitt when he was captured by the Nootka Sound Indians, and the wreck of the *Princess* on Prince Edward Island. But there are many other spirited adventures in the book, including early trans-Atlantic voyages, the wreck of the *St. Lawrence* on Cape Breton Island, the loss of the *Charles Eaton* in Torres Strait, and the amazing adventures of the German commerce raider *Seeadler* in the war. The illustrations include a number of old prints from the Macpherson collection. The book certainly achieves the author's modest aim of providing the reader with the opportunity of getting away for an hour or two from the monotony of safe civilization.

R N. R. B.

GLENRIDDING FLOOD OF 1927

We have received from Mr. Thomas Hay an account of the Glenridding flood of 28–29 October 1927, from which the following notes have been selected for comparison with Messrs. Fearnsides and Wilcockson's paper on the Dolgarrog flood (*G.J.*, November 1928). When allowance is made for the much smaller scale of the Glenridding flood, its effect upon the topography was very similar to that at Dolgarrog. The flood was caused by the breaking of the dam, partly natural and partly artificial, at Keppel Cove Tarn, on the east side of the Helvellyn range about 3 miles to the west of the Glenridding Beck mouth. The flood cut a deep wide gash in the dam, approximately 35 feet deep and 50 feet wide at the top. It is possible that the water was re-excavating a V-shaped exit which had been filled up before the dam was heightened. The damage seems to have been done by one great mass of water, which is thought not to have taken more than a quarter of an hour in passing Mr. Hay, unfortunately, is unable to give any estimate of the volume of water involved. but assuming that the average depth of the tarn was 30 feet, a generous estimate, this would give a total volume of over 7 million cubic feet, as compared with the 120 million cubic feet that burst from Llyn Eigiau. From the tarn to Ullswater, the fall is 1350 feet approximately 450 feet per mile. The gradient is remarkably regular, except that it is slightly steeper in the upper than in the lower course : also in the eight rocky gorges which interrupt the stream-bed, the fall is steeper. Thus, though the total fall is slightly greater than that from Llyn Eigiau to Dolgarrog, there are no gradients comparable to those of 1 in 2 and 1 in 4 at the Rhaiadr Porth Llwyd.

Immediately below the tarn, at the junction with the Brown Cove stream, the stream has deepened its bed 3 feet below the level of the latter. In turning into the valley, it has exposed 20 feet of live rock on the right bank, depositing rubble on the left. It has then undercut a bank of boulder clay and removed great slabs of turf. All the way down vegetation and turf have been torn from the banks. Wherever the solid rock has been uncovered the newly exposed rock is bleached by the action of the humic acids of the peaty vegetation. Throughout the course of the flood there is no evidence that solid rock has been removed in big quantities, but much has been removed in the shape of small corner pieces, knocked off by the impact of boulders, especially in the upper gorges, where the gradient was greatest. The bleached parts on salients projecting upstream have been removed by these collisions. The level of the gorges has not, however, been changed.

Between the gorges there is deposition of boulders from the great depth of boulder-clay in the upper valley, and sometimes of more or less sorted materials. Immediately above the Power House there is half a mile of boulders, large and small, some 120 cubic feet or more, the first great accumulation. Below the mine there is a similar deposition. A little lower down the stream has widened and uncovered an old bed, revealing a mosaic-like mass of water-worn brecchia bleached by peat-action. Below this point the level of the stream has been raised practically throughout, except in the gorges. This amounts to an average of about 3 feet. The village was probably saved by a copse just above a sharp turn, for several floating trees were trapped, holding up many boulders in the copse. In the village, the old bed being so choked with detritus, the stream burst its left bank and spread over the fields, overturning walls and depositing soil and boulders. This overflowing is repeated whenever the stream is in spate. In the delta, a recently dug channel running eastwards was completely blocked up, and the stream broke away to the north-east; but during a later flood it

deserted this new channel, and began to excavate the new cut, the main outlet finally pointing south-east. The whole of the semicircle of the recent delta was covered with more or less graded material, mostly smaller in size than the earlier material.

INDUSTRIAL GEOGRAPHY OF LANCASHIRE

The *Journal of the Manchester Geographical Society* for 1927 (vol. 43), issued in July 1928, constitutes a special Lancastrian number dealing with the geographical basis of industry in Lancashire and the adjacent parts of Cheshire. Mr. H. W. Ogden treats of the geographical basis of the cotton industry, Mr. H. W. Barker of the towns of south-east Lancashire, Mr. H. King of the agricultural geography of Lancastria, and M. W. Fitzgerald of the Ribble Basin.

Mr. Ogden fully disposes of the fallacy that the cotton industry of Lancashire is specifically related to atmospheric humidity. That such a belief should have become more or less general as shown by its repetition from text-book to text-book, cannot fail to have puzzled any one who knew that there is nothing very distinctive about relative humidity in Lancashire. So far as this is a factor at all it applies to the whole of England. Mr. Ogden goes on to show that the determining factor of the distribution of the cotton industry, apart from accessibility to coal supplies, is abundance of water of the right quality. The quantity of water required is ensured by the heavy rainfall and high percentage of run-off, and the quality by the absence of lime, for soft water is essential especially for the processes of dyeing and bleaching, and for boiler use. Such water is abundantly supplied by the Rossendale and Pennine grits and sandstone, but in those valleys where the water is derived from the Carboniferous limestone such as the Upper Ribble and its right-bank tributary the Hodder, the cotton industry almost entirely fails. Towns to the north of the Rossendale ridge, such as Blackburn and Burnley, are mainly devoted to weaving; those to the south of it, like Bolton and Rochdale, to spinning: but the underlying reason for this differentiation of function still awaits solution. Preston combines both functions about equally, and the otherwise distinctive status of Preston among the greater Lancashire towns is brought out by Mr. Fitzgerald. Its present-day industries are more varied; lying near the agricultural district of the Fylde, with the country reaching unspoiled almost into its very streets, it is also a centre for farmers. Its position in respect of north-south and east-west routes has given it special importance. It lies in a narrow part of the Lancashire plain between the coastal marshes and the Bowland fells and Rossendale uplands on the route between England and Scotland, and it also lies at the western end of the highway into Yorkshire by way of the Ribble valley and the Aire gap of the Pennines. The importance of Preston as a modern railway centre is reflected in its most spacious station not of terminal, or mainly terminal, character in the country, whilst its importance as a seaport is increasing.

Mr. King's paper relates the different agricultural activities to the types of soil met with in the region, and brings out the fact that even in agriculture Lancashire is a highly industrialized county. Most of the reclaimed "mosses" have been brought under the plough. Mr. Barker's paper discusses the origin and growth of a "conurbation" consisting of twenty-two towns of which Manchester-Salford is the regional capital. It is shown that there is much more individuality about the several towns than the hasty traveller is wont to realize. The geographical reasons for the origin and development of such places as Macclesfield, Stockport, Warrington, Bury, Accrington, and Oldham are well brought out. Generally growth has been about the nuclei of parish church and market-place, but while this independence of origin has fostered an independence

of outlook, contiguity is calling for a certain coordination of public services, and future town-planning. This suggests an academic question, for which, however, it seems desirable that geographers should find an answer: what does, or should, define the individuality of a town? for the question may be important in statistical comparison.

EARLY IRRIGATION IN THE PANJAB

In the course of his review of Mr. H. K. Trevaskis' 'Land of the Five Rivers' in the November *Journal*, Sir Louis Dane wrote (p. 463): "Such canals existed probably before historical times parallel to but above the Swat Canal in Peshawar and parallel to the great Lower Chenab Canal. The latter, as the width of the old channel indicates, was a very great work." Mr. E. S. Lindley, of the Panjab Irrigation Department, then wrote to ascertain in detail the surface indications which had led Sir Louis to this conclusion, before they were obliterated by cultivation. Mr. Lindley had not discovered traces of ancient canals during his service in this district before the upper part was irrigated. From his researches into the history of Punjab irrigation he had concluded that no ancient canals have been discovered in the Rechna Doab, few canals in the Panjab cannot be dated approximately, and no early works are describable as "very great." Though the sites now being excavated in the Panjab are at most on the edge of the lowlands only, some do exist in the uplands, and in view of present irrigation schemes, it would be of interest to know whether these sites flourished under a more genial climate, or were fed by canals. Sir Louis Dane replied that he was referring to his own observations as District Commissioner in the Jhang District in 1886. This was before the Lower Chenab Canal had been started, and he travelled about checking measurements of the sporadic rainfall cultivation carried on in good years. In the Khurianwala tract to the east of the present Lyallpour, he came across the banks of a canal about 100 feet wide, weathered and worn, but still distinct for a considerable distance. Lady Dane also remembers the finding of these banks, which must have been ploughed down very soon after in the colonization begun in 1890. It was probably on this canal that Sangla and some of the other ruined cities, built with the very large bricks distinguishing them from more modern sites, stood, or the canal may have antedated even Alexander. In the course of his duties, Sir Louis also came upon traces of the old Swat canal, and he believes they were known to the irrigation officers, though lying above the line of the Lower Swat Canal.

THE OLIVE INDUSTRY IN FRENCH NORTH AFRICA

An interesting sketch of the history of the olive in North Africa from early times, and of the great development which its culture has attained in recent years, is given by MM. Payen and Ladreit de Lacharrière in the *Renseignements Coloniaux*, 1928, No. 6. All the early travellers and writers, classical and Arab, bear witness to the importance of the olive harvest in their times. The Arab invasion ruined the industry for a time, but it regained ground, and in the Turkish period a large trade in olive-oil, direct or indirect, was done by Marseille, most then coming from Tunis, for the export from Morocco was for some time interdicted. After the French conquest of Algeria, improved methods of cultivation were slowly introduced, but development was delayed for a time by the slight encouragement given by the home government. In Tunis olive cultivation was at a low ebb in the time of the later Beys, and it was some time after the French occupation before any great development ensued. The flourishing nature of the industry in the protectorate to-day may be ascribed almost entirely to the energy and enthusiasm of Paul Bourde, who, calling in the aid of native cultivators, established thriving plantations which so altered the position

that production has assumed great proportions. This is especially true of Sfax, where the number of trees had more than trebled between 1896 and 1926. In Algeria there has been a steady though less marked increase in the number of trees since the beginning of the century, though the figures for the production of oil show a good deal of fluctuation, due in great measure to the occurrence of good or bad seasons. The memoir is accompanied by a map showing the distribution of olive culture in French North Africa. Although the olive is par excellence the tree of the Mediterranean region, and shows extraordinary vitality even when the circumstances are unfavourable, the regions of greater abundance are somewhat widely scattered. In Morocco there are four, separated by tracts in which the tree almost disappears; and in Algeria the department of Oran shows much smaller areas than Algiers and Constantine, where more or less homogeneous tracts extend for some 200 km. south of the coast-line. In Tunis the olive habitat stretches continuously from west of Bizerta to near Gabes, though here as elsewhere intensive culture is localized in certain districts. Although the modern development has been mainly due to the establishment of artificial plantations, a good deal of the produce is still derived from the wild trees, especially in Morocco.

NEW DIVISIONS OF CHILE

By a decree of the President of the Republic, Señor Carlos Ibañez, taking effect from 1 February 1928, the administrative divisions of Chile have been reorganized. This decree was based upon the findings of a commission, the Report of which, together with the decree and other documents, is published in the *Revista Chilena de Historia y Geografia*, Abril–Junio 1928. Before the change Chile was divided administratively into twenty-three provinces, subdivided into eighty-two departments. These divisions were often the result of historical accident, or at least had ceased to bear close relation to the social and economic life of the country: moreover, the large number of boundaries interfered with commercial intercourse. Accordingly, the Commission was appointed to examine the question, having regard to the individual characteristics of the various regions, their situation, population, communications, etc., and to separate out those regions united by real community of interests. The decree, which slightly modified the recommendations of the commission, therefore abolished seven provinces, and reduced the number of departments, so that Chile is now organized as sixteen provinces and sixty-two departments. The provinces absorbed are, from north to south, Valparaiso (being united with Aconcagua, Valparaiso remaining the provincial capital), O'Higgins, Curico, Linares, Malleco, Arauco, and Llanquihué. There is thus little change in Northern and Central Chile; the greatest rearrangement has taken place in the south. The Province of Chiloe comprises the former provinces of Chiloe and Llanquihué, with the exception of the northern district round Osorno, which is considered to have closer ties with Valdivia. Puerto Montt, thanks to its better railway communications, becomes the provincial capital. All the area to the south, as far as the line Rio Trinidad, Eyre Sound, and Trinidad Channel (south of Wellington Island), is constituted a new territory, "Territorio de Aysen," with Puerto Aysen as chief town. This reduces somewhat the extent of the "Territorio de Magallanes." The step has been taken to stimulate the economic development of the region by removing it from the Province of Llanquihué, and placing it more directly under the control of the State. In the following article, Señor Alberto Edwards, the chairman of the Commission, discusses the potentialities of Aysen and the preliminary steps required for its development. The chief obstacle is the isolation of the interior agricultural valleys from the

littoral, which is causing their sparse population to turn rather towards the Argentine in seeking contact with the outside world.

PLANTS AS INDICATORS OF GROUND-WATER

It has been recognized from very early times that the presence in arid regions of underground water-supplies may be indicated by the nature of the plants growing on the surface. But it is only in comparatively recent years that the question has been studied scientifically and comprehensively, and that chiefly in the United States, where the vast area of arid lands in the south-west gives a special importance to the subject. The results of recent investigations are summarized by Mr. O. E. Meinzer in *Water-Supply Paper* 577 of the U.S. Geological Survey (Washington 1927). The writer deals first with the various evidences that plants of certain species possess the ground-water habit or adaptation (depending for their luxuriant growth mainly on their capacity of utilizing the ground-water by pushing down their roots towards it) while others are without it. Some plants, for instance, grow throughout the summer through the help of ground-water while others are then dormant. Even those of the first category show considerable differences, for in the areas of shallow ground-water which occupy the lowest parts of desert-basins, concentric belts of vegetation are often seen, in each of which one or more ground-water species is dominant. After treating in detail of the principal species of this class and describing their strongly developed root system, the author ends by discussing the value of plants as indicators of ground-water conditions in arid regions. To the traveller they may be of supreme importance as pointing out localities where water is likely to be obtained or directing him to existing watering-places. Further, as different species have different limits of depth they may show to some extent the depth of the water-table. Thus, while Mexican salt grass rarely pushes its roots below 36 feet, the Mesquite is known to go down to as much as 50 feet. Plants may also help to indicate the quality and still more the quantity of the water supply, the latter being deduced from the rate at which they discharge water by transpiration without sensibly diminishing the underground reservoir. A knowledge of the conditions is of practical value, for if plants that can themselves lift the water from below can be put to economic use, the cost of pumping for irrigation may be obviated. The desired result can be obtained by developing more valuable varieties either of established ground-water plants, or of other valuable plants that show certain tendencies this way. A special note by Mr. W. N. White dwells on the advantages of alfalfa from this point of view, a diagram, based on actual examination by excavation, showing that in one case the root-system of an alfalfa plant had penetrated to a depth of 9 feet. The paper is well illustrated by maps and photographs.

PERIODICITY OF FLOODS

Having collected together records of exceptional high levels and floods of European rivers, particularly French, M. Maurice Pardé discusses the question whether catastrophes from such inundations are likely to be less frequent in future (*Materiaux pour l'étude des calamités*, No. 17, 1928). From one series he is able to draw some assurance. The Isère at Grenoble is the cause of constant anxiety, yet, while its level reached above 5·4 metres in 1773, 1740, 1778, and 1859, it has only once since reached 3·4 metres, that is in 1914. Similarly its confluent, the Drac, has been quiet for the last fifty years, since its exceptional levels of 4 metres in 1843 and 4·2 metres in 1876. The Loire and the Allier are two other rivers with a bad reputation for disastrous floods. In 1790, 1825, 1846, 1856, and 1866 great damage was done in the plains after heavy rainfalls—that is, practically every ten years. Since then serious trouble has occurred only

in 1872 and 1907, but not on a comparable scale, and augmented by dykes giving way. The upper Tarn reached well above 10 metres at Albi in 1766, and almost as much at Montauban, where levels above that figure were recorded in 1772, 1807, and 1826. From the last date the highest level reached has been 8 metres in 1872. M. Pardé then shows that a series of examples may be selected, in some cases from different portions of the same rivers, to convey the opposite impression—of increasing liability to floods. The Lower Loire and its tributaries are a striking example: the Vienne has undergone four violent crises in the last thirty years, the two highest recorded levels being at Chatellerault in 1913 and at Chinon in 1923; on the lower Loire, the high level and the breaking of the dykes in 1910 produced notorious damage, which was nearly repeated in 1923. Similar examples might be drawn from the records of the Cévenole rivers, or from the Rhone. At Lyons, between 1840 and 1856 it reached 5 metres on several occasions: a break then intervened until 1882 (5·77 metres). From 1889–1910, on four occasions it was between 5 and 5·5 metres, eventually reaching 5·9 metres in 1918. This might have been thought to be the culminating point, yet in 1923 and 1925 these figures were equalled, with the exceptional level of 6·1 metres following in 1928.

M. Pardé then endeavours to draw conclusions from these examples: he submits that they exhibit a periodicity in their occurrence, though there is insufficient evidence to determine it accurately. He therefore warns dwellers along rivers which have recently experienced immunity from floods not to count upon a continuance of this favour, for there has been no such change in the climate of Europe to justify this hope. To this warning he adds a further, that since perhaps once or twice on each river an outstanding flood has been recorded, such an one, or even a worse, is not impossible in the future. The chances of these exceptional floods are greater in rivers with large basins, from 20,000 to 100,000 kms. in area, especially if exposed to several climatic regimes. The floods of 1840 on the lower Rhone were caused by the conjuncture of oceanic and Mediterranean rainstorms, both of abnormal intensity, followed, at the moment when the river was at its maximum after the first downpour, by two more Mediterranean storms. Again, where factors bringing about a great increase of the coefficient of the "run-off" may be present, catastrophic floods may still be looked for. In zones where summer floods occur, a preliminary saturation of the soil will permit what would otherwise be but a moderate rainstorm to produce dangerous flooding, by reducing the disparity between the normal and the theoretical maximum run-off. M. Pardé concludes with the advice to those responsible for control works to regard rivers as "organismes dont le passé n'a peut-être pas encore révélé toute la nocuité latente."

JOHN MORE'S WALL-MAP OF CANAAN

The Society having recently acquired a mounted and coloured copy of a finely engraved early wall-map of "The Land of Canaan, with the city of Jerusalem," a few notes on the history of the map may not be amiss. Its original compiler, John More, was a puritan divine of the latter half of the sixteenth century, who, educated at Christ's College, Cambridge (of which he became a fellow), spent the greater part of his life as incumbent of St. Andrew's, Norwich. The map was not printed in his lifetime (he died in 1592), but is said to have been afterwards published by Speed, though no copy of this early issue is to be found at the British Museum. The original plates having been destroyed in the fire of London, the map was re-engraved by Francis Lamb (known for other cartographical work of the period) and published in 1683 by Robert Greene, "revised and corrected by a careful hand." Even of this first re-issue there

appears to be no specimen in the British Museum, the two copies there bearing the imprints of Carington Bowles and of Bowles and Carver respectively, while that now in the Society's possession is "published by Rich[d] H. Laurie," these being three successive designations of the same well-known firm of map-sellers. The last issue took place some time after 1832, which date appears in the water-mark of the paper, but in each case the original date 1683 still appears.

The map, mounted as a whole with an ornamental border, measures 6 feet 5 inches by 4 feet 7 inches, and includes a large plan of Jerusalem in the top left corner. The map proper is well filled with detail with copious references to the passages in the Bible where the several places are mentioned. It includes lower Egypt and the Sinai peninsula, and shows the route of the Israelites in their wanderings from Egypt to Canaan. The 1683 issue was dedicated to King Charles II, and there are portraits of More and Speed above, and to the right of, an inscription explaining the genesis of the map. Curiously enough the figure to the left represents the Woman of Samaria.

It should be mentioned that a small version of More's map, "continued and finished by John Speed," was brought out in 1611, and re-issued by Christopher Browne in 1651. Copies of both issues are in the British Museum. It is of the usual size of an Atlas map, and one wonders why it was never included in Speed's "Prospect of the most Famous Parts of the World." A still smaller map of Canaan was given in Speed's 'Genealogies' of *c.* 1611.

MEETINGS: SESSION 1928–1929

Third Evening Meeting, 3 December 1928. The President in the Chair

Elections: Lieut. Desmond R. Crone, R.E.; Roger C. Düdt, M.A.; Capt. Edward Baddeley Elkington, R.E.; Philip Francis Oliver Frith, M.C.; Alfred Craven Hargrove; Santosh Kumar Lahiri; Wisbey Montague Eugene Martin, M.A.; Eric Alston Mott, M.A.; Gerald Rhys Phillips, B.SC.; The Rev. Richard Crofton Sleigh; Miss Eva Stuart-Watt; Anand Swarupa, B.A.; Walter James Trimble; Commr. Claude Lombard Aubry Woollard, R.N.; James William Wyatt, M.I.C.E.

Paper: The South-east Borderland of the Rub 'al Khali. By Captain B. S. Thomas

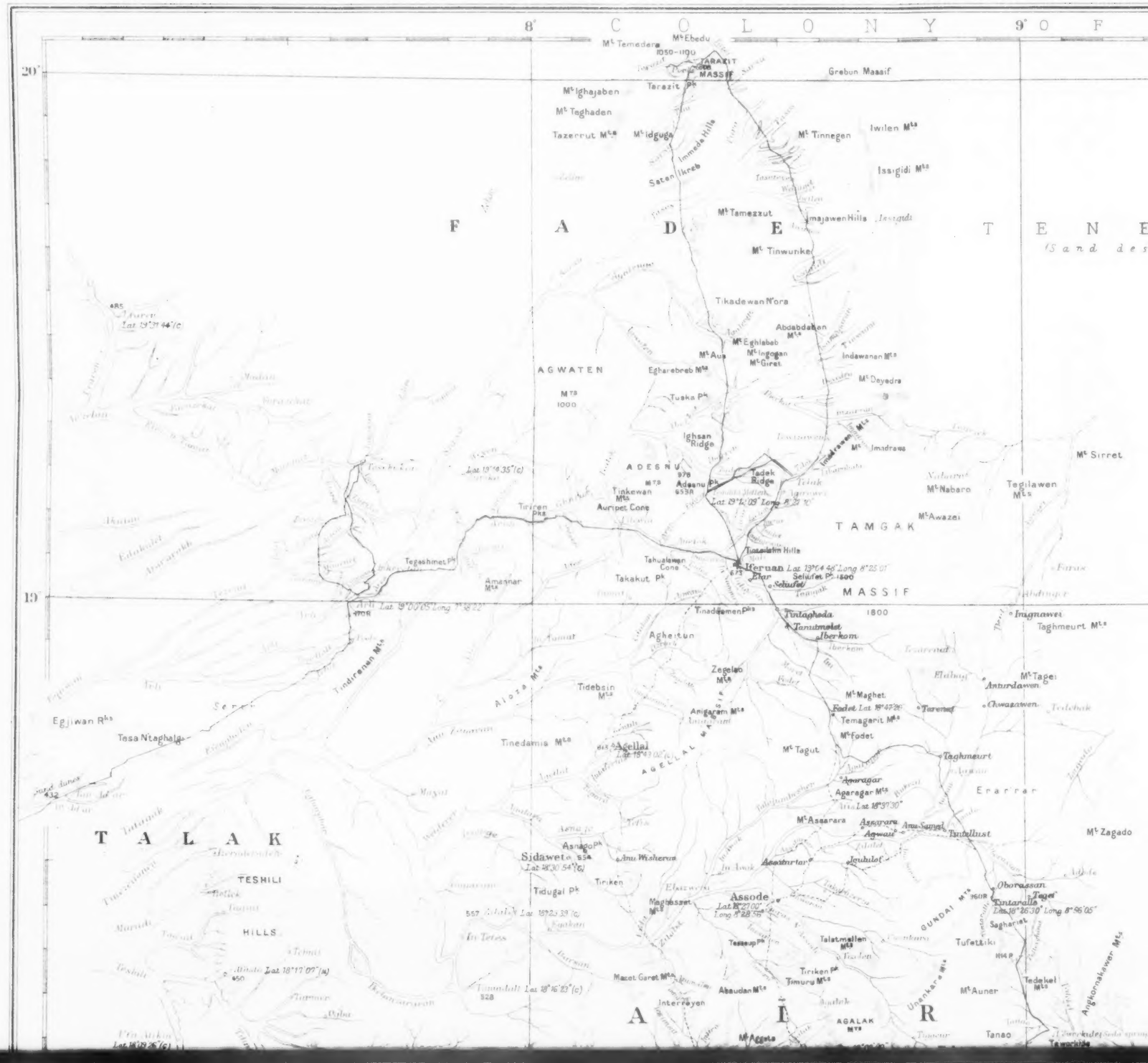
Second Afternoon Meeting, 10 December 1928. The President in the Chair

Papers: A new equal-area projection for world maps. By S. W. Boggs
A retro-azimuthal equidistant projection of the whole sphere. B
A. R. Hinks
An oblique Mollweide projection. By J. Fairgrieve
A reverse equal-azimuth chart. By E. A. Reeves

Fourth Evening Meeting, 17 December 1928. The President in the Chair

Elections: Miss Marion E. Bloor, B.SC.; Walter Bruce Chisholm, B.A.; Hen
Ernest Crawley; Benjamin England; Mrs. Barbara Maitland-Govan; Mauri
Fruin Lowe, B.SC., A.K.C.; B. A. Massee; Bimol Mukerjee; Kermit Rooseve
Colonel Theodore Roosevelt; Paymaster-Lt.-Comm. William Arthur Sharp, R.

Papers: Captain Cook: Papers in commemoration of the Bicentenary of h
birth by Sir Henry Newbolt, Prof. J. Holland Rose, Rear-Admiral H. P. Dougla
and Sir Frank Dyson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SOUTH CENTRAL SAHARA

(SHEET I)

AÏR AND DAMERGU

From surveys by F. Rodd 1922

F. Rodd, P. Rodd and A. Courtauld 1927.

and previous French maps.

Scale 1:1000,000

10 5 0 10 20 30 40 50

Statute Miles

10 5 0 10 20 30 40 50

Kilometres

The routes of the expeditions and adjacent country are from prismatic compass and watch traverses, supplemented by theodolite triangulation and plane-tabling, adjusted, at the points shown, by astronomical observations taken with a 3 inch micrometer theodolite. Latitudes are from pairs of circummeridian N. & S. stars and Polaris. Longitudes from pairs of E. & W. stars for L.M.T., with G.M.T. by wireless time signals from Bordeaux and Nauen. Points fixed astronomically used in the construction of the map, in addition to those of the expeditions, are shown by initial letters (N) Neiger, (C) Cortier, (F) Foureau. Heights are in metres, those determined by the 1927 expedition being distinguished thus (R) They are from boiling point readings, computed from mean sea level. The following French maps have been incorporated in drawing the map:—Mission du Transafricain, Jan.–Nov., 1912. Carte des Régions parcourues par la Mission, dressée par le capitaine Nieger, chef de Mission, 1924, Scale 1: 400,000; A Service Géographique des Colonies, Mission Cortier, Carte de l'Air, dressée par le capitaine Cortier et l'adjudant Malroux, 1912, Scale 1: 500,000. For further information see appendix to paper which accompanies this map.

Reference

Routes in 1922

" " 1927

Watercourses (non permanent)

Dry valley beds

Wells & rain pools

ARWA Mts

Koronkoro

Timilen Mts

Iguelawel

Tinda

TIMIA MASSIF

ANFISSAC Mts

Aunissao Mts

Tgeyen Mts

Mt Gheshwa (Volcano)

Mt Akoraki

Mt Marc

Atenhet Mts

Azamaqaran Mts

Adenga Mts

Mt Sampfochi

BILA Mts

Igelugal

1350–1400

Zarobi Hills

Hills

Arenat Mts

Tesile Pk

Aburakan

Lat 18°03'30" Long 8°41'36"

Aunissao Gap

Old village

Pools & palms

Cemetery & Mosque

Old village & well

Mosque

Auveran

Lat 17°56'54"

Teguiqui

Lat 17°58'20"

Volcanic rocks

Tagora Rocks

Fintatenwa Rocks

Inteuet

Amuter Lat 18°09'00" Long 8°32'32"

Arau Magheran

In Nemel

Tuofow

Tagherot

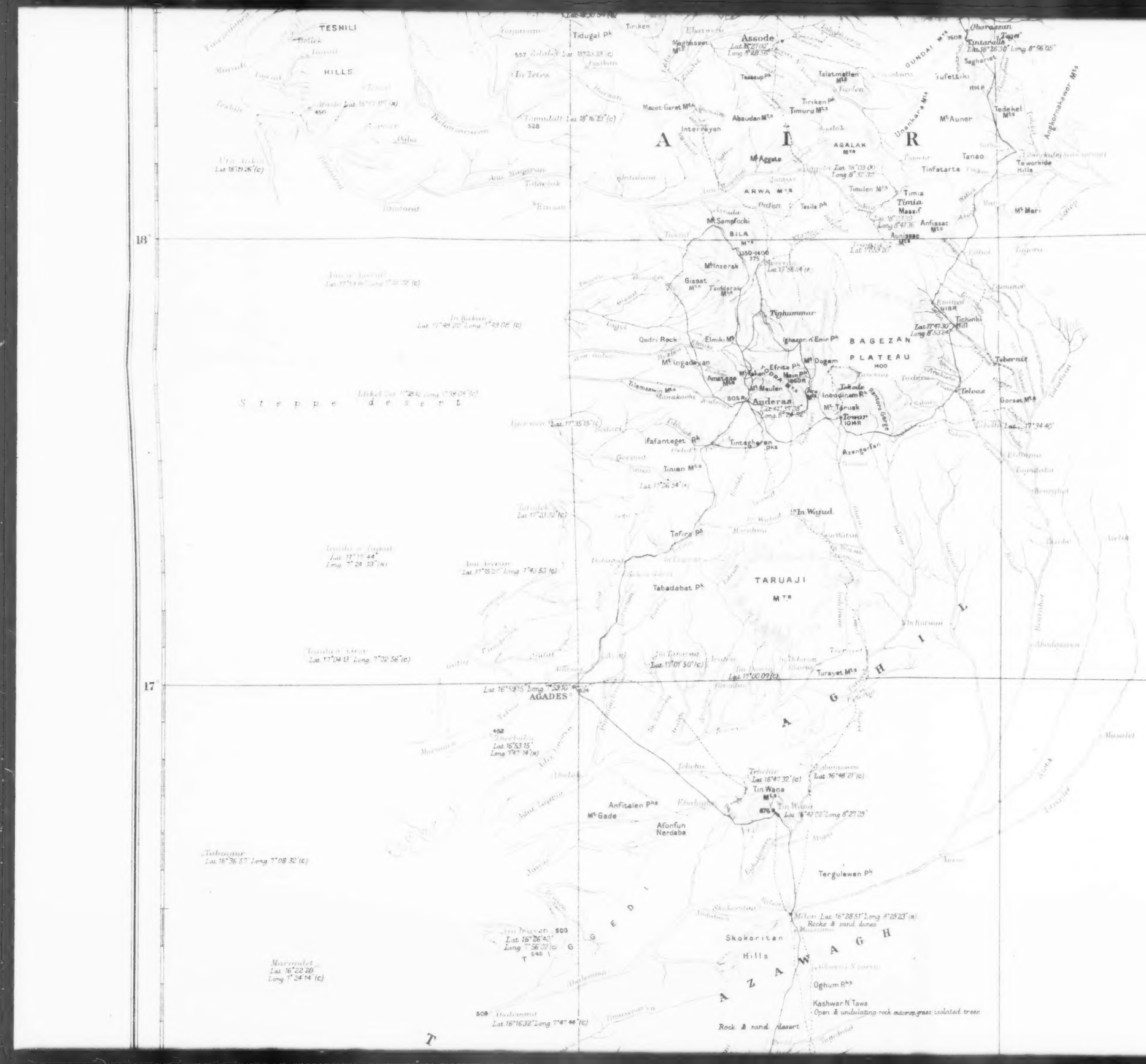
Tafarhat

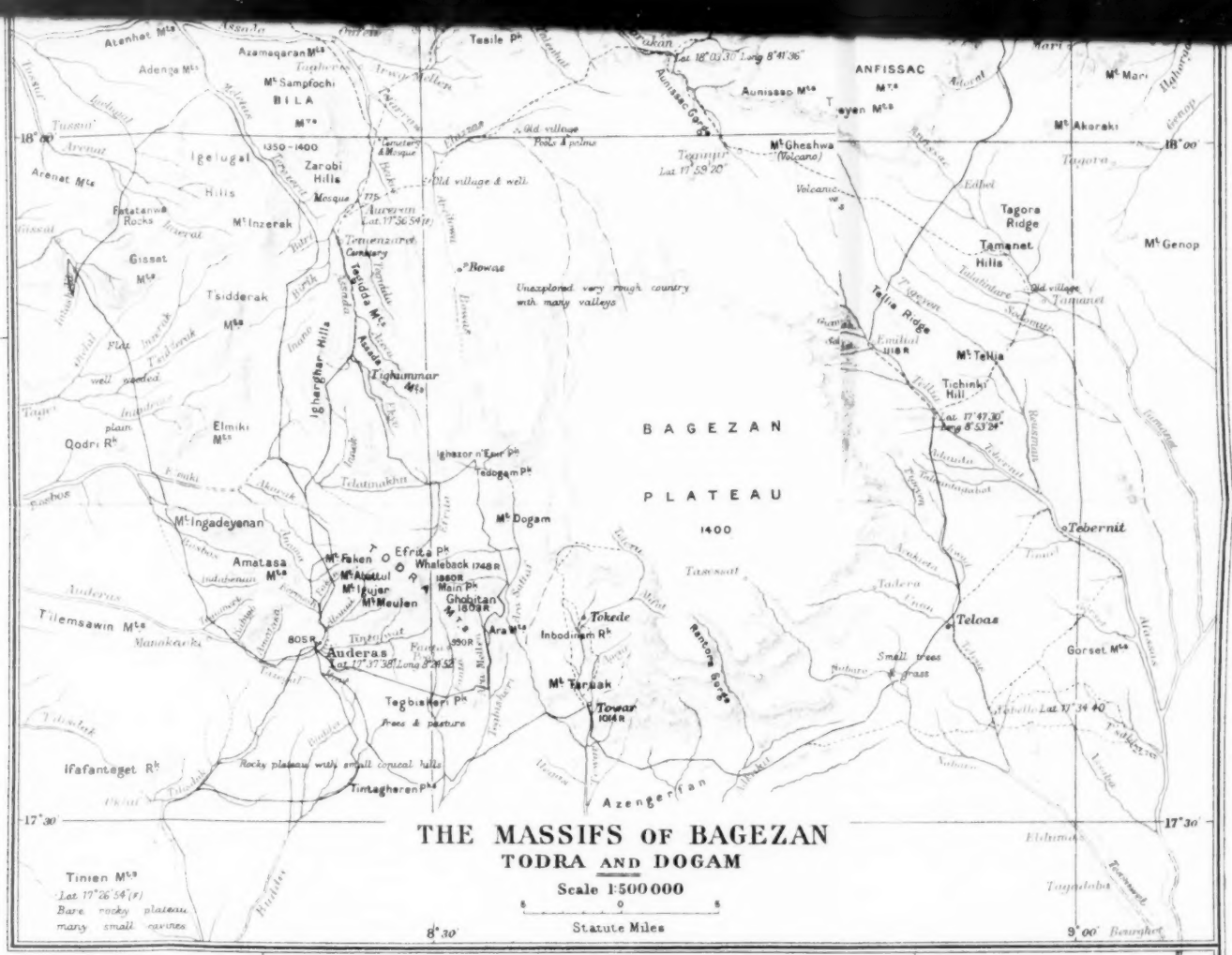
Tinkie

Tatarmat

Mari

Tagora


TESHILI
HILLS
Tidugal Pk
Tiriken
Assode
Lat 16°27'00"
Long 7°28'56"
Maghassyet
Oberazzan
Tazer
Lat 18°26'38" Long 8°56'05"
Segharet
GUNDAI
Tefetsiki
Tezeup Pk
Talatmatten
Tiriken Pk
Timuru
Mazet Garet
Abaudan
Tedekel
Mt Auner
Interfeyen
A I R
AGALAK
Mt Agous
Tanao
Tinfatarta
Teworkide Hills
Lat 18°09'00
Long 8°30'37"
ARWA
Timia
Timia Massif
Mt Marr
Mt Sampfochi
BILA
Anfissac
Aunissene
1350-1400
Mt Inzenak
Gissat
Tsidderak
Tighummar
Tichenki
Lat 17°47'30"
Long 8°53'24"
Qodri Rock
Elmiki
Ighazer n Enir Pk
BAGEZAN
PLATEAU
1400
Mt Ingadeyan
Efraze Pk
Mt Dogam
Tabernit
Mt Meulen
Inoodinam
Anderas
Lat 17°37'28"
Long 8°24'02"
Mt Taruak
Tower
Telcas
Gorset
Tintagheren
Azengofan
Tinian
Lat 17°26'54"
In Wajud
Tefina
TARUAJI
Mts
Tabadabat Pk
Turayet
Lat 17°00'00"(c)
Lat 16°59'15" Long 7°59'10"
AGADES
Lat 16°53'15"
Long 7°47'14"(c)
Trichic
Lat 16°47'32"(c)
Lat 16°48'21"(c)
Tin Wana
Anfitalen Pks
Mt Gade
Afonfun
Nerdaba
Lat 16°42'02" Long 8°27'29"
Tergulawen Pk
Melen Lat 16°28'51" Long 8°28'23"(c)
Rocks & sand dunes
Skokoritan
Hills
Oghum Rks
Kashwar N'Tawa
Open & undulating rock outcrop grass isolated trees
Rock & sand desert
Lat 16°16'32" Long 7°47'44"(c)
Marrandet
Lat 16°22'20"
Long 7°24'14"(c)
Tabazaur
Lat 16°36'57" Long 7°08'32"(c)
Lat 17°04'13" Long 7°20'56"(c)
Lat 17°01'50"(c)
Lat 17°35'15"(c)
Lat 17°23'32"(c)
Lat 17°15'20" Long 7°43'53"(c)
Lat 17°19'44"
Long 7°26'33"(N)
Lat 17°24'22" Long 7°49'08"(c)
Lat 17°37'48" Long 7°28'32"(c)
Lat 18°21'26"(c)
Lat 18°15'33"(c)
Lat 18°16'23"(c)
Lat 18°23'39"(c)
Lat 17°58'54"(c)
Lat 17°55'20"
Lat 17°34'40"
Lat 17°26'40"
Long 7°56'02"(c)
Long 7°49'08"(c)
Long 7°43'53"(c)
Long 7°20'56"(c)
Long 7°08'32"(c)
Long 7°24'14"(c)
Long 7°47'44"(c)
Long 8°27'29"
Long 8°28'23"(N)
Long 8°56'05"
Long 8°30'37"
Long 8°53'24"
Long 8°24'02"
Long 8°27'29"
Steppe desert
T
A
G
H
I
L
E
D
A
W
A
G
H
A
Z
A
W
A
G
H
18°
17°



THE MASSIFS OF BAGEZAN
TODRA AND DOGAM

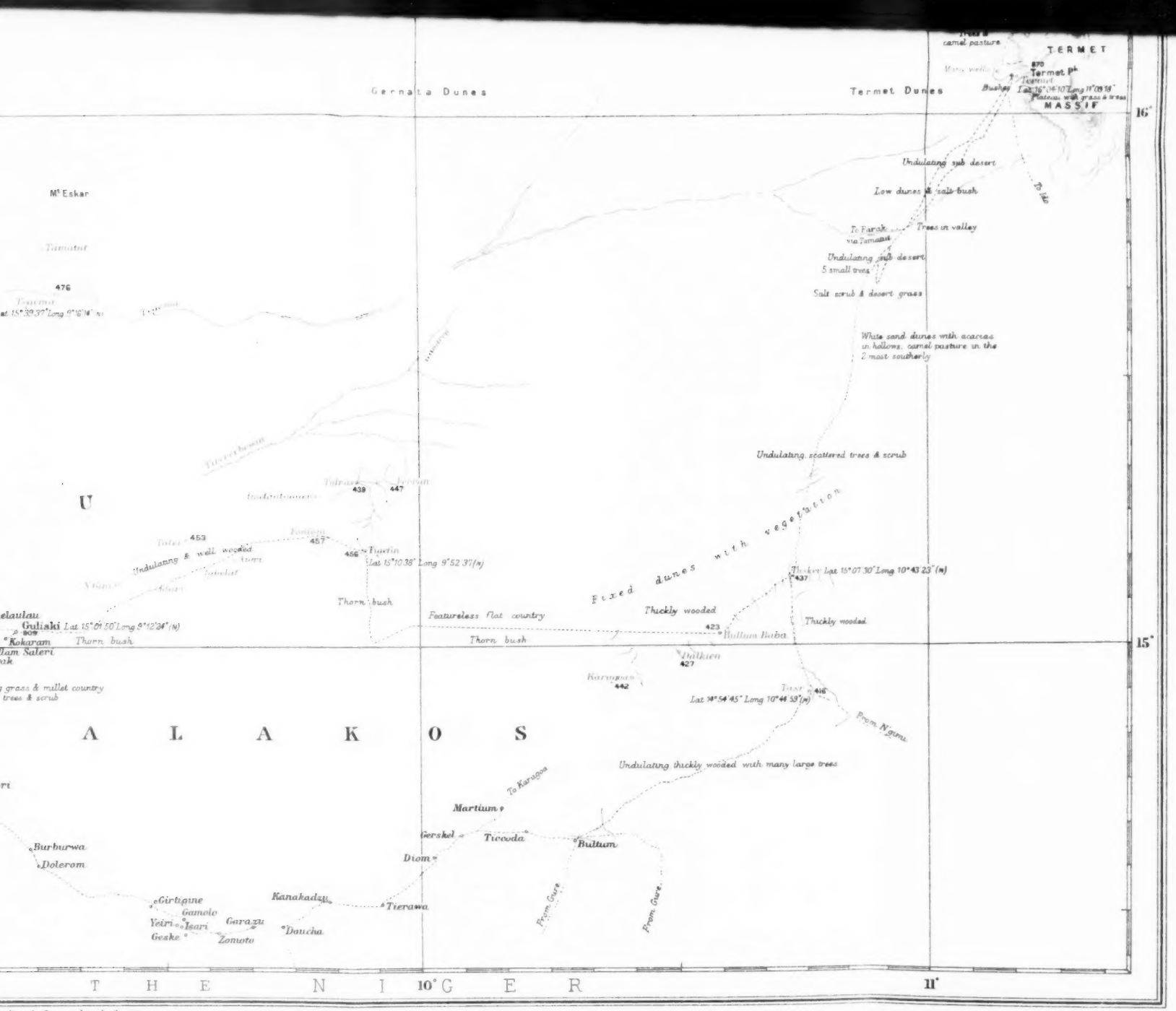
Scale 1:500000

5 0 5 Statute Miles

T E N E R E

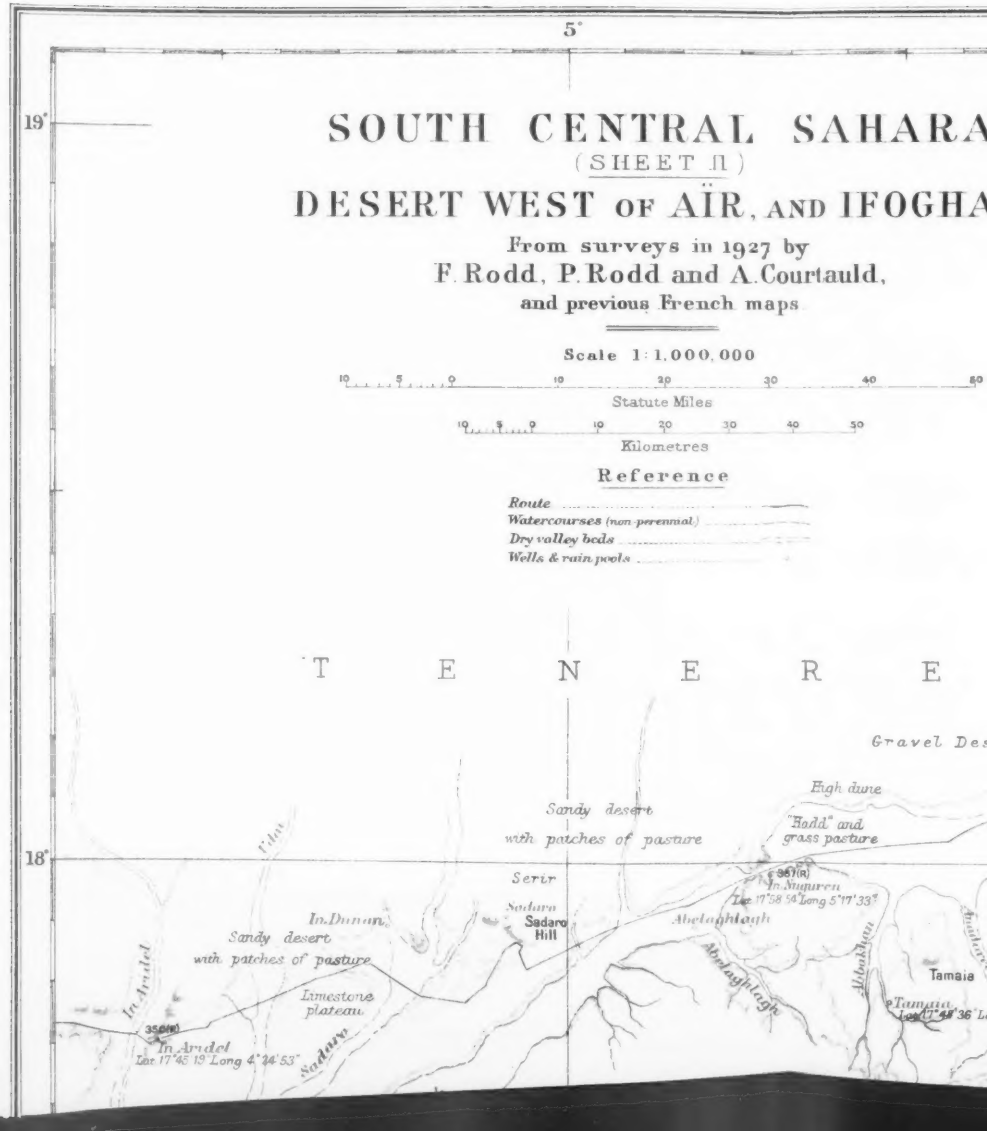
Sand desert

Published by the Royal Geogr

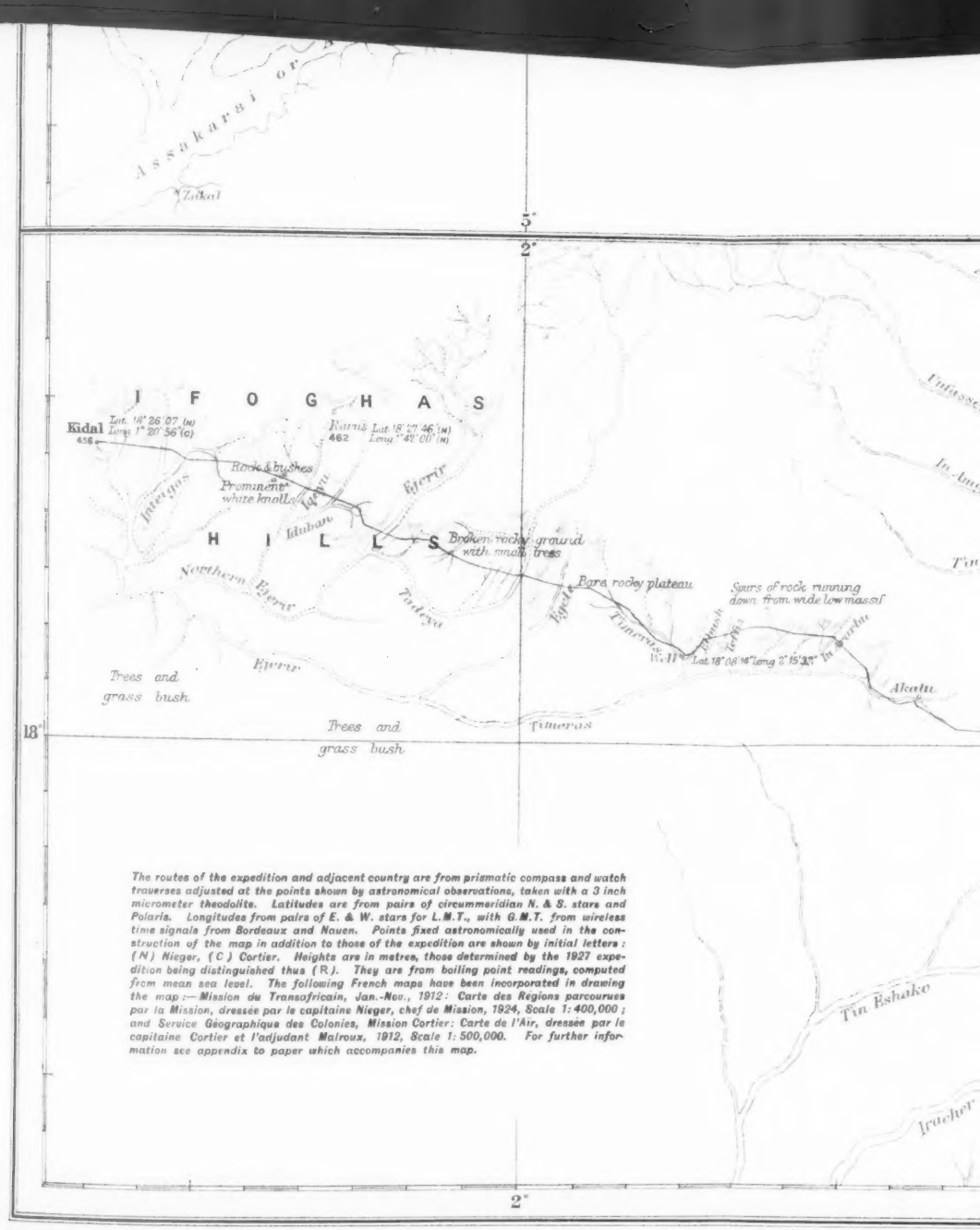


Royal Geographical Society

SOUTH CENTRAL SAHARA
Rodd


5°
19°
SOUTH CENTRAL SAHARA
(SHEET II)
DESERT WEST OF AÏR, AND IFOGHA
From surveys in 1927 by
F. Rodd, P. Rodd and A. Courtauld,
and previous French maps
Scale 1:1,000,000
10 5 0 10 20 30 40 50
Statute Miles
10 5 0 10 20 30 40 50
Kilometres
Reference
Route
Watercourses (non-perennial)
Dry valley beds
Wells & rain pools
T E N E R E
Gravel Des
High dune
Sandy desert
with patches of pasture
"Rodd" and
grass pasture
18°
Serir
Sadaro
Hill
In Nuguren
Lat. 17°58'54" Long 5°17'33"
In Dunun
Sandy desert
with patches of pasture
Limestone
plateau
In Arudel
Lat. 17°46'19" Long 4°24'53"
Abelaghlagh
Tamaia

6°
7°
19°
18°
HARA
TOGHAS
In Tadrift
Lat. 19° 03' 46" Long. 6° 32' 01"
Inkeretan
Arli
Arli
Arli
Tagellalt
Tindrenen
Egiiwan
Egiiwan Rks
Tesa N'taghalgi
Sert
Eregnaten
Sand dunes
In Ad'ar
Tafagak
Gravel Desert
Gravel Desert
Gravel Desert
Gravel Desert
TALAK
Tezaderaden
467
TESHILI
HILLS
Tag'ant
Tagant
Tagant
Tagant
Takut N'Kutat
394
Lat. 18° 21' 40" (a)
In Allarun
Lat. 18° 16' 12" (c)
In Allarun
In Khuddesh
Vegetation
Battal
350 (a)
Lat. 18° 11' 24" Long. 6° 16' 52"
Anu Zaggaran Trees
Trees
Trees
Tesallaman Desert
Abarakat
Ag'erdemmat
Tibaken
Tabbarosh
Tiaret
Tiaret
Tesalit
Mirsta
450
Lat. 18° 10' 0" (a)
Tarmer
Ogba
Tiantarat
Titintarat
In Abdungarit
Lat. 17° 53' 07" (c)
Tamaia
Long. 5° 29' 26" (v)
20°
10°
0°
10°
RIO DEL ORO
Scale 1: 25,000,000
100 0 100 200 300 400 500
Statute Miles



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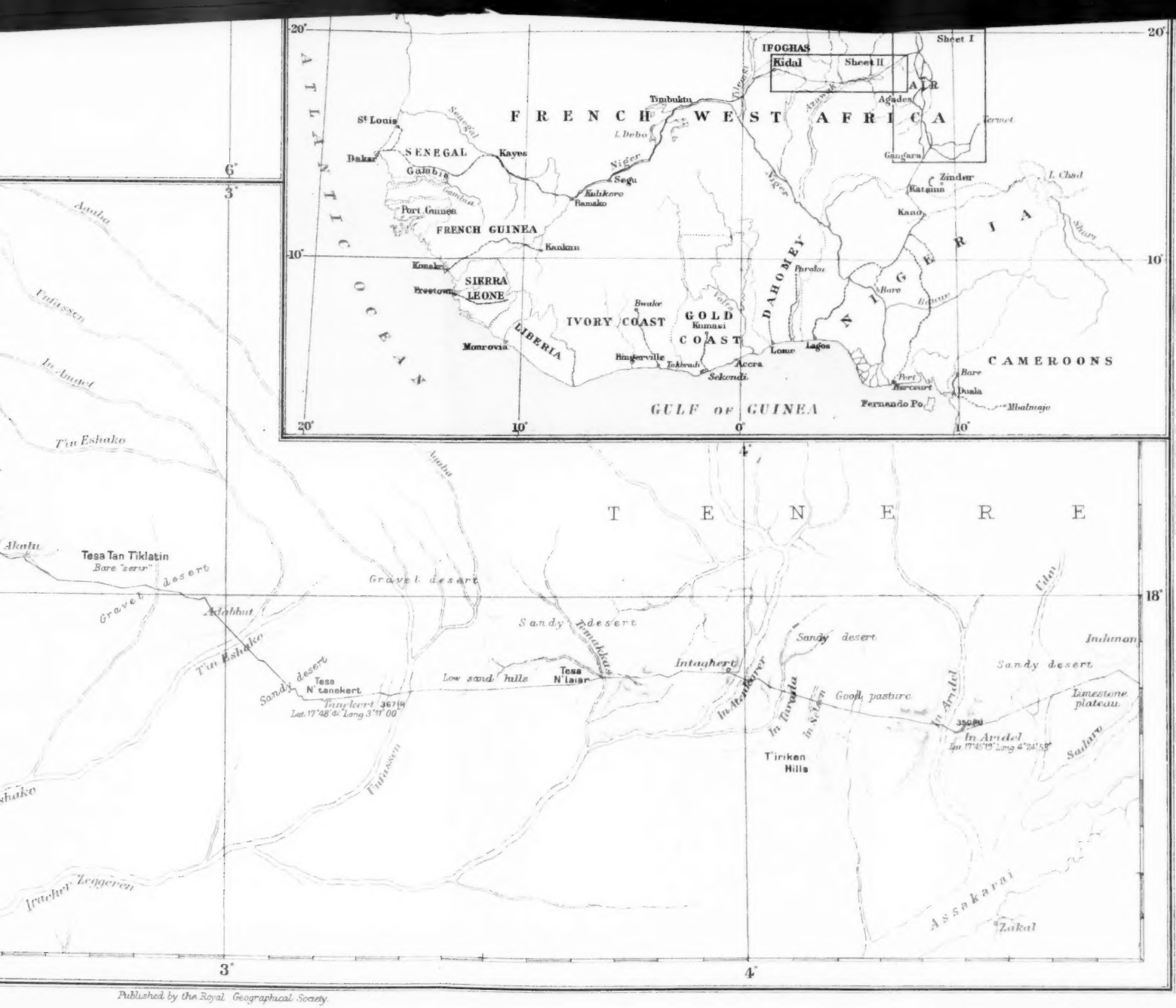

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SOUTH CENTRAL SAHARA
Rodd